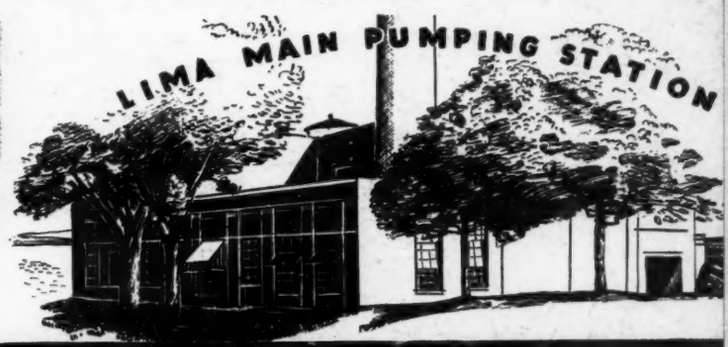
WATER WORKS & SEWERAGE

A GILLETTE PUBLICATION

EDITOR

AUGUST 1937
VOLUME 84, No.

Lima OHIO



Situated on the Ottawa River, in the very heart of northwestern Ohio, Lima is a busy city of some 60,000 people. Incorporated as a city in 1842, with only 757 inhabitants, it became the county seat of Allen County. When the peak of production in the rich surrounding oil fields was passed, Lima concentrated its energies on manufacturing industries. In Lima today are made locomotives, steam shovels, woolens, motor trucks, electric signs, tobaccos, petroleum products, and many other items of industry.

The history of Lima's water supply is interesting. Begun in 1887, and owned since that time by the city, the system first made use of a small impounding reservoir on nearby Lost Creek. As demand increased with the population, wells were drilled and additional storage facilities were provided. A modern filtration plant was installed in 1919. Today the residents of Lima need have no fear of water shortage, for the system has adequate capacity to care for any and all needs.

Lima, another city using Pittsburgh Water Meters, is well below the State average for the net cost of water to its consumers.

PITTSBURGH EQUITABLE METER CO.
MERCO NORDSTROM VALVE CO.
MAIN OFFICES PITTSBURGH, PA.

NEW YORK	LOS ANGELES	TULSA	HOUSTON	MEMPHIS	BUFFALO
DENVER	KANSAS CITY	CHICAGO	PHILADELPHIA	ATLANTA	OAKLAND

PITTSBURGH WATER METERS

Lithographed on stone by James E. Allen, Copyright 1937, U. S. Pipe & Foundry Co.

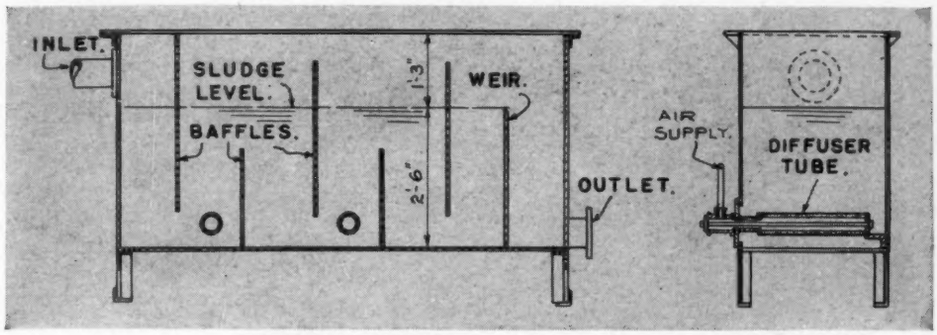
THAT LONG LIFE is inherent in cast iron pipe is demonstrated by century-old water and gas mains still in service. For these veterans were made before the introduction of such great improvements in cast iron pipe manufacture as vertical pouring (pit cast pipe) and centrifugal casting. Obviously, the cast iron pipe buyer today gets a still finer and more uniform product. For example, Super-de Lavaud Pipe, centrifugally cast in a metal mold *without chill* by our patented process, combines perfect concentricity and uniform wall thickness with high tensile strength and extraordinary resistance to impact.

U.S. cast iron PIPE

Cast iron and alloy cast iron pipe centrifugally or pit cast — for water works, gas, sewerage and drainage service as well as industrial uses involving corrosives.

U. S. PIPE & FOUNDRY CO.
BURLINGTON, NEW JERSEY
Foundries and Sales Offices throughout the U. S.

FORCEFUL FACTS ON SEWAGE AERATION BY AIR DIFFUSION No. 13



LONGITUDINAL SECTION CROSS SECTION

Standard type of sludge mixing tank furnished with Oliver-United Vacuum Filters, for conditioning and flocculation of sludge with chemicals

MIXING BY AIR DIFFUSION

is the most efficient method of sewage sludge conditioning

1 Conditioning with ferric chloride or other coagulating chemical to produce satisfactory dewatering on vacuum filters.

2 Conditioning with lime to promote and maintain optimum digestion conditions.

3 Conditioning by elutriation with water to reduce quantity of chemicals required.

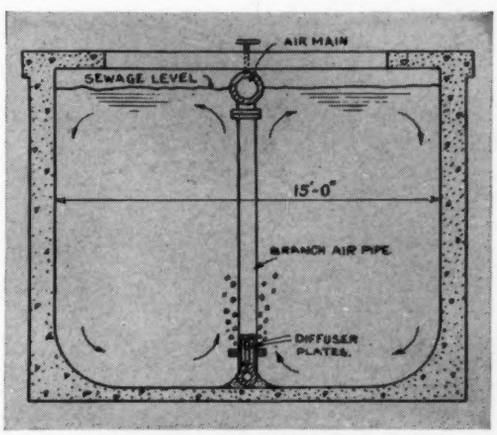
HERE ARE THE OUTSTANDING REASONS FOR MIXING BY AIR DIFFUSION

SIMPLICITY—No extra driving equipment. No moving parts in sludge. No stuffing boxes to lubricate. Low maintenance cost.

LOW FIRST COST—Diffuser cost is low compared to mechanical paddles. Additional blower capacity, when required, costs less than mechanical driving equipment.

LOW OPERATING COST—Air used is at low pressure and is usually from source required for some other operation, hence but little additional power is consumed.

FLEXIBILITY—Regulation of mixing in any part of compartment of a mixing tank may be varied or the degree of mixing of an entire unit may be quickly controlled by regulating the air valve on each diffuser unit. This flexibility is helpful where quantity and quality of sludge vary.



Mixing tank design (W. M. Piatt) using vertical diffuser plates

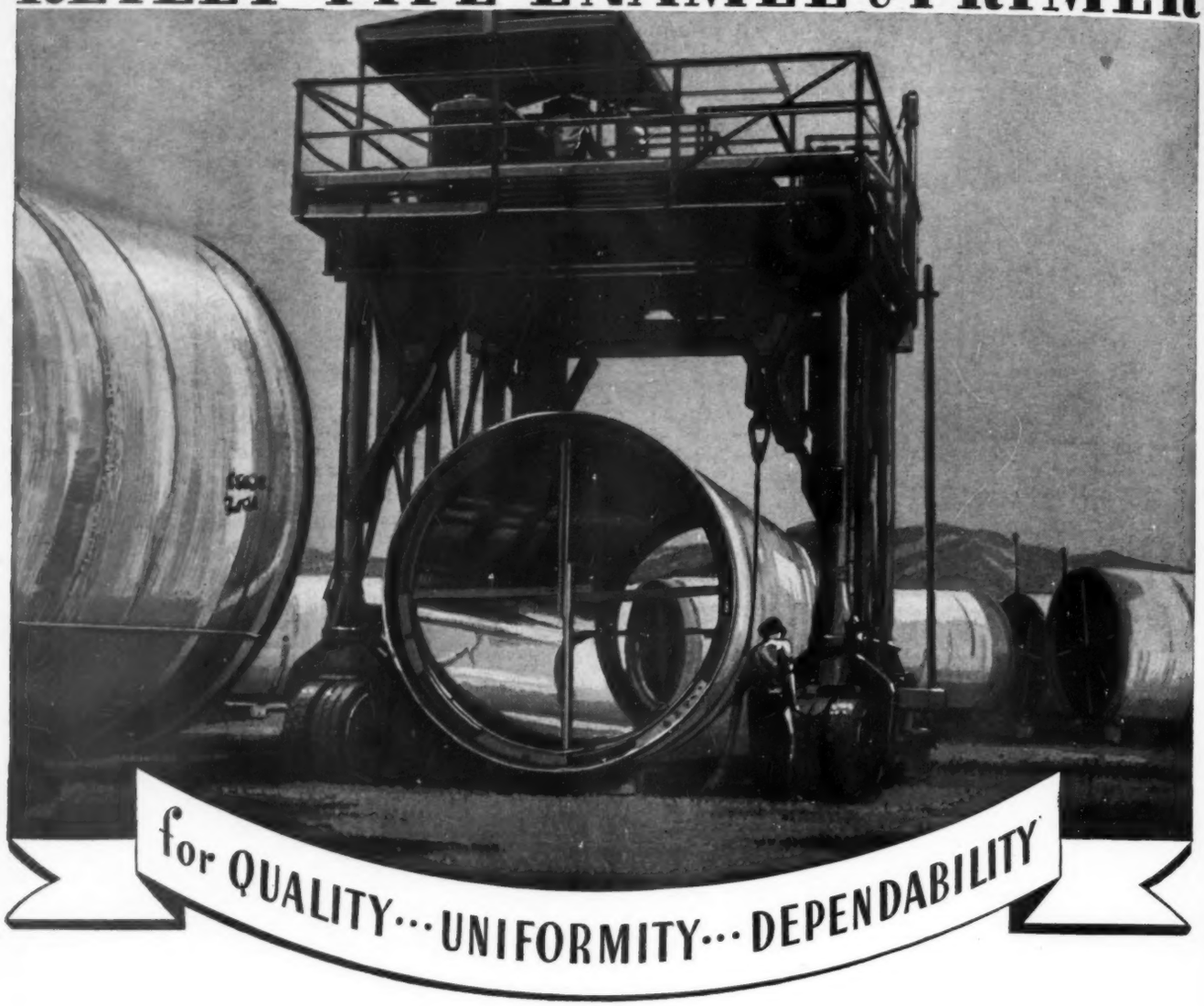
ALOXITE BRAND
REG. U.S. PAT. OFF.
DIFFUSER MEDIA
PLATES AND TUBES

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

Sales Offices and Warehouses in New York, Chicago, Boston, Philadelphia, Cleveland, Detroit, Cincinnati, Pittsburgh, Grand Rapids
(Carborundum and Aloxite are registered trade-marks of The Carborundum Company)

WATER WORKS AND SEWERAGE, August, 1937, Volume 84, Number 8. Published monthly at 400 West Madison Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, $2.00 per year; Canadian and Foreign, $3.00 per year. Copyright, 1937. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under the Act of March 3, 1879.

REILLY PIPE ENAMEL & PRIMER



You cannot afford to gamble with pipe enamel . . . it must have the endurance to stand up indefinitely to all of the destructive influences to which a pipe line is subjected. Reilly Pipe Enamel and Primer give maximum protection either as a coating or as a lining. This material possesses those inherent characteristics which assure resistance to rapid and extreme temperature changes . . . without sagging or checking . . . protection against soil acids or alkalies and electrolysis. Properly applied, Reilly Pipe Enamel clings to the steel with a bond unequalled. This material has defied the most rigid tests yet devised . . . and we will welcome the opportunity to demonstrate its merits to you. Your inquiries are always welcome.

REILLY TAR & CHEMICAL
. . . CORPORATION . . .
Executive Offices
MERCHANTS BANK BUILDING
INDIANAPOLIS . . . . . INDIANA

Reilly
COAL TAR PRODUCTS

500 FIFTH AVENUE . . . . . NEW YORK, N. Y.
2513 S. DAMEN AVENUE . . CHICAGO, ILLINOIS
ST. LOUIS PARK . . . . . MINNEAPOLIS, MINN.
15 PLANTS TO SERVE YOU

NATION SIZZLES AS HEAT SETS NEW RECORDS
102.3 DEGREES - ALL TIME HIGH
TORRID WAVE ON WAY BACK, SAYS KIMBALL
DROUGHT DEATHS SOAR ABOVE 200
RAINS FALL
San Francisco Chronicle
DEGREES - ALL TIME HIGH
SHOWERS COMING, BUT NO RELIEF
TIME HIGH
DROUGHT DEAD FIGURED AT 21

"Hot as H...!"

● HOT AS HADES: Every year during this period, heat waves bring about the usual run of troubles for Mr. Plant Operator.

1. Low water conditions, or actual shortage of raw water.

2. Excessive algae and other organic growths in raw water supplies, resulting in excessive tastes and odors.

3. Reduced turbidity in the water supply, making coagulation difficult and shortening filter runs.

4. Greater increased consumer demand.

In a paper read by E. A. Sigworth before the 4-States Section Meeting of the American Water Works Association, Philadelphia, Pa., April 22-24, 1937, a cross section of returned Questionnaires indicated that hot weather was the period in which tastes and odors predominate.

This means that the Plant Operator is confronted with his greatest problem during this period and is particularly "pushed" to the limit to furnish a water that is palatable. One means of helping with this problem is the application of AQUA NUCHAR as an aid to better coagulation, and for its all around use as a taste and odor remover.

Make your plans now to attend the Annual Convention of the Southwest Section of the American Water Works Association to be held October 18-21, 1937, at the Hotel Driskill, Austin, Tex.

230 PARK AVENUE
NEW YORK, N. Y.

417 SCHOFIELD BLDG.,
CLEVELAND, OHIO

205 W. WACKER DRIVE
CHICAGO, ILL.

INDUSTRIAL CHEMICAL SALES

DIVISION WEST VIRGINIA PULP AND PAPER COMPANY

30" sewer pipe for Liberty, N. Y., lined and coated with Bitumastic 70B Enamel, then wrapped with felt.

STEEL OR IRON PIPE *with*

TIGHT JOINTS THAT STAY TIGHT

THE HIGHEST FLOW CAPACITY KNOWN

ABSOLUTE PROTECTION AGAINST TUBERCULATION AND CORROSION

SPUN BITUMASTIC LINING ASSURES ALL THREE

The selection of sizes for sanitary sewer pipe has been simplified. In your calculations, the factors for infiltration, tuberculation and corrosion may be omitted through the use of metal pipe (which assures tight joints that stay tight) and Bitumastic Enamel. Spun Bitumastic lining permanently prevents tuberculation and corrosion from increasing friction, affecting pipe, retarding flow or reducing pump efficiency. Initial pipe sizes can therefore be reduced, since capacities will be sustained and friction greatly reduced—enabling you to include more footage in your program. Tests show that spun Bitumastic lining has an average Hazen-Williams Coefficient of C=155 on pipe 16" dia. and larger; 145 on smaller pipe—better than .010 for "n" in Kutter's formula, based on longer lengths of metal pipe. Field examinations prove that this coating has been unaffected even after nearly 30 years of actual water and sewage service.

Spun Bitumastic lining is practical on metal sanitary sewer pipe 6" to 72" dia. and larger. It is economical—often paying for itself in less than one year. Application can be at pipe mill, foundry or on the job. Further particulars about this half-century-old product are available on request.

SPUN BITUMASTIC LINING

1. Reduces friction.
2. Permits smaller pipe diameters—consequently more footage of pipe.
3. Eliminates deterioration of pipe surface.
4. Maintains highest possible flow for years.
5. Unaffected by sewage or usual industrial wastes.
6. Reduces power requirements for force mains.
7. Permits selecting and operating pumps with maximum efficiency.
8. Saves on excavation costs.
9. Permits use of flatter slopes in mains.
10. Eliminates future replacements with larger mains to compensate reduced capacities.

BITUMASTIC PRODUCTS ARE USED IN SEWAGE DISPOSAL PLANTS FOR: Bar Screen Mechanism • Aerator Piping • Exteriors of Pumps, Pipe and Miscellaneous Metal Parts • Valve Stands • Hand Railings • Drive Units • Concrete Floors, Walls and Machine Bases • Concrete below sewage level • Pumping Stations • Screen Chambers • Clarifiers • Clarifier Steel Work • Flocculator Tanks • Flocculator Steel Work • Digesters • Digestion Tanks and Covers.

[Also Manufacturers of INDUSTRIAL PAINTS for All Exterior and Interior Plant Surfaces]

WAILES DOVE-HERMISTON CORPORATION

BOSTON PHILADELPHIA CLEVELAND CHICAGO TULSA SAN FRANCISCO LOS ANGELES

17 BATTERY PLACE, NEW YORK, N. Y.

AS P·DM PRACTICES IT,

Elevated Tank design is a fine art

Past are the days when elevated tanks were homely "blots on the landscape" . . . structures serving their purpose, but lacking entirely in "eye appeal". How different the modern towers,—when designed by P·DM architect-engineers!

Working within the limitations imposed by each installation, P·DM craftsmen succeed in relating practical demands with clean functional pattern . . . harmonizing mass and line into an attractive whole. Every P·DM Elevated Tank has the grace of sound proportion, whether it be a 5,000 gallon Hemispherical Bottom unit or a Toroidal Tank one thousand times as large.

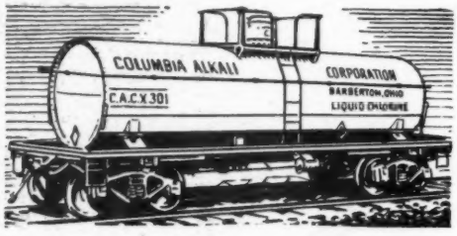
PITTSBURGH · DES MOINES STEEL CO.

PITTSBURGH, PA. 3418 NEVILLE ISLAND—DES MOINES, IA. 919 TUTTLE ST.

NEW YORK, ROOM 918-99, 270 BROADWAY . . . CHICAGO, 1222 FIRST NATIONAL BANK BUILDING

DALLAS, 1223 PRAETORIAN BUILDING . . . SAN FRANCISCO, 625 RIALTO BUILDING

COLUMBIA



LIQUID CHLORINE

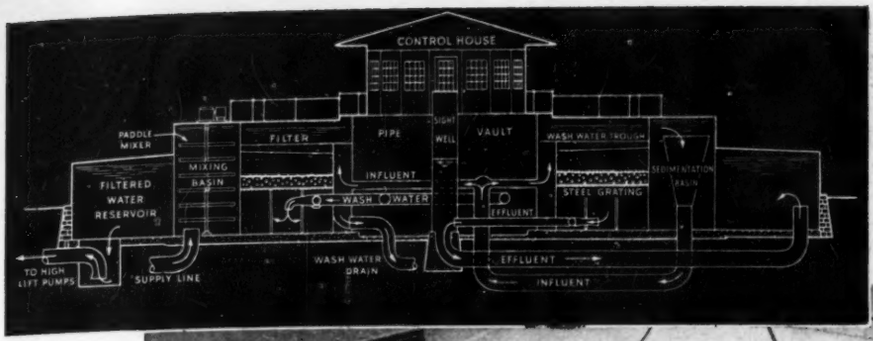
In Single and Multiple Unit
Tank Cars,

Also 100 and 150 lb. Cylinders

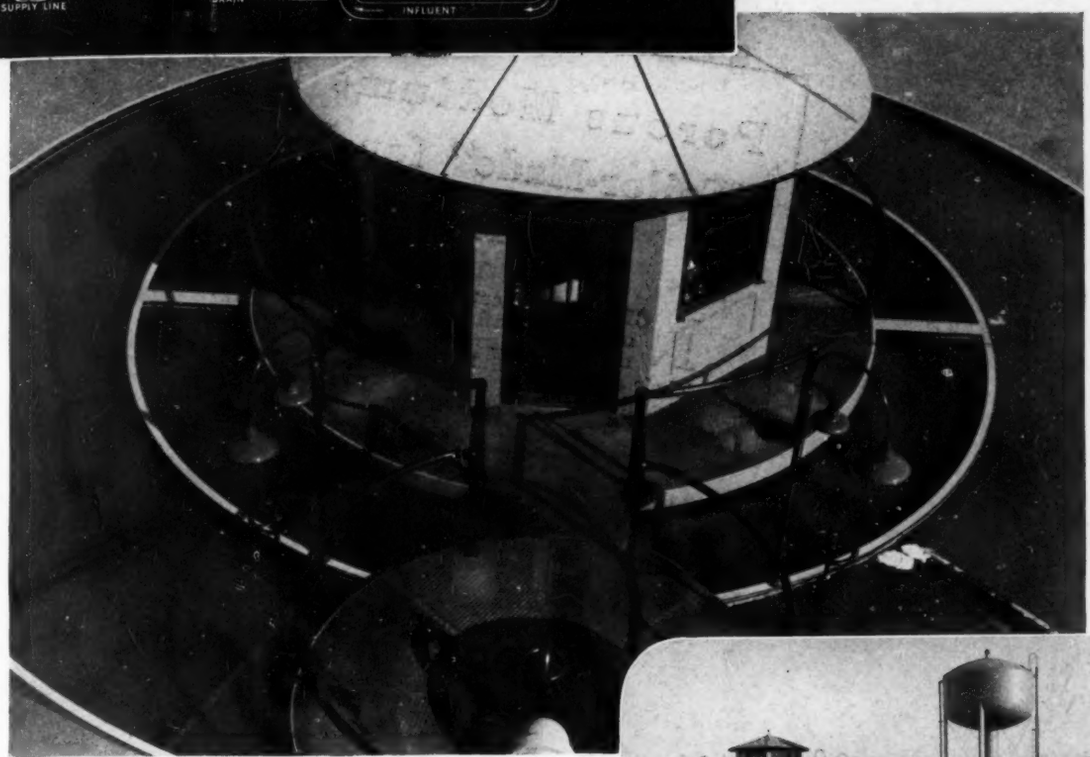
THE COLUMBIA ALKALI CORPORATION

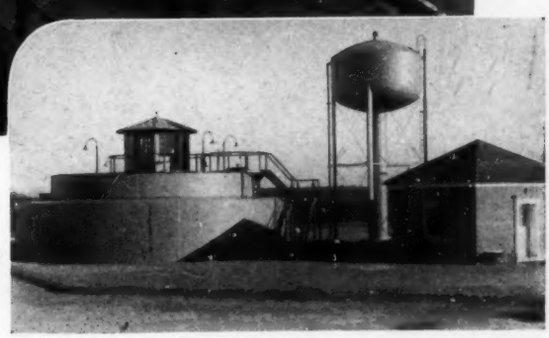
BARBERTON • OHIO

NEW YORK BOSTON MINNEAPOLIS
CHICAGO CLEVELAND CINCINNATI
ST. LOUIS PITTSBURGH



THE MORSE *ALL-STEEL* Filter Plant



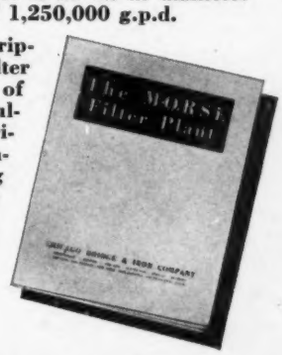


Built to meet your requirements!

IN many respects, utilization of the Morse Filter Plant in your waterworks system is just like the procedure followed when installing elevated storage tanks: First you make, or have made, a survey of your requirements. . . . Then prepare the engineering plan that will give you the most favorable balance of capacity, efficiency, convenience, economy, etc. In preparing this plan, be sure to capitalize on the exclusive advantages offered by the Morse All-Steel unit. . . . Outline your requirements when giving your specifications for fittings, auxiliary equipment, etc. . . . We believe you will be gratified to find how well the Morse plant will fit into your plans and to discover how convenient and economical it is to install them in complete units.

The above pictures show a general view and a close-up of a Morse Filter Plant installed at Lorton, Va. This unit is 50 ft. in diameter and has a capacity of 1,250,000 g.p.d.

For a complete description of Morse Filter Plants, get a copy of our new illustrated bulletin. It lists the various points to be considered when making plans and asking for quotations. Free on request. Address our nearest office.



CHICAGO BRIDGE & IRON COMPANY

Fabricating plants in CHICAGO, BIRMINGHAM, and GREENVILLE, PA.

Chicago.....2198 Old Colony Bldg.	Dallas..1479 Dallas Ath. Club Bldg.	Houston.....2919 Main St.	Boston.1548 Consolidated Gas Bldg.
New York.3390-165 Broadway Bldg.	Birmingham....1586 North 50th St.	Detroit.....1551 Lafayette Bldg.	San Francisco....1083 Rialto Bldg.
Cleveland....2262 Rockefeller Bldg.	Tulsa.....1646 Hunt Bldg.	Philadelphia..1644-1700 Walnut St.	Los Angeles...1455 Wm. Fox Bldg.

Porous Mediums that are "Tailor-Made" for Your Plant

NORTON PLATES AND TUBES

NORTON engineers were the first to produce porous mediums consisting of electrically fused alumina abrasive grains held together with a vitrified bond. Their ability to build into Norton Porous Mediums those qualities essential to efficient aeration of sewage and water is founded on more than fifty years' experience in the manufacture of grinding wheels—a process requiring control of extreme delicacy. This experience developed the exclusive "Controlled Structure" method of manufacture and has resulted in the development of porous mediums having to the highest degree those desirable qualities—efficient aeration, low wet pressure loss and longest useful life.

This manufacturing control covers fusing of the Alundum* in arc furnaces—crushing the raw material to given grain sizes—shaping the grain to the desirable shape—bonding the grain into the moulded piece having the properties desired—firing the moulded piece at high temperature and testing the piece to assure its quality.

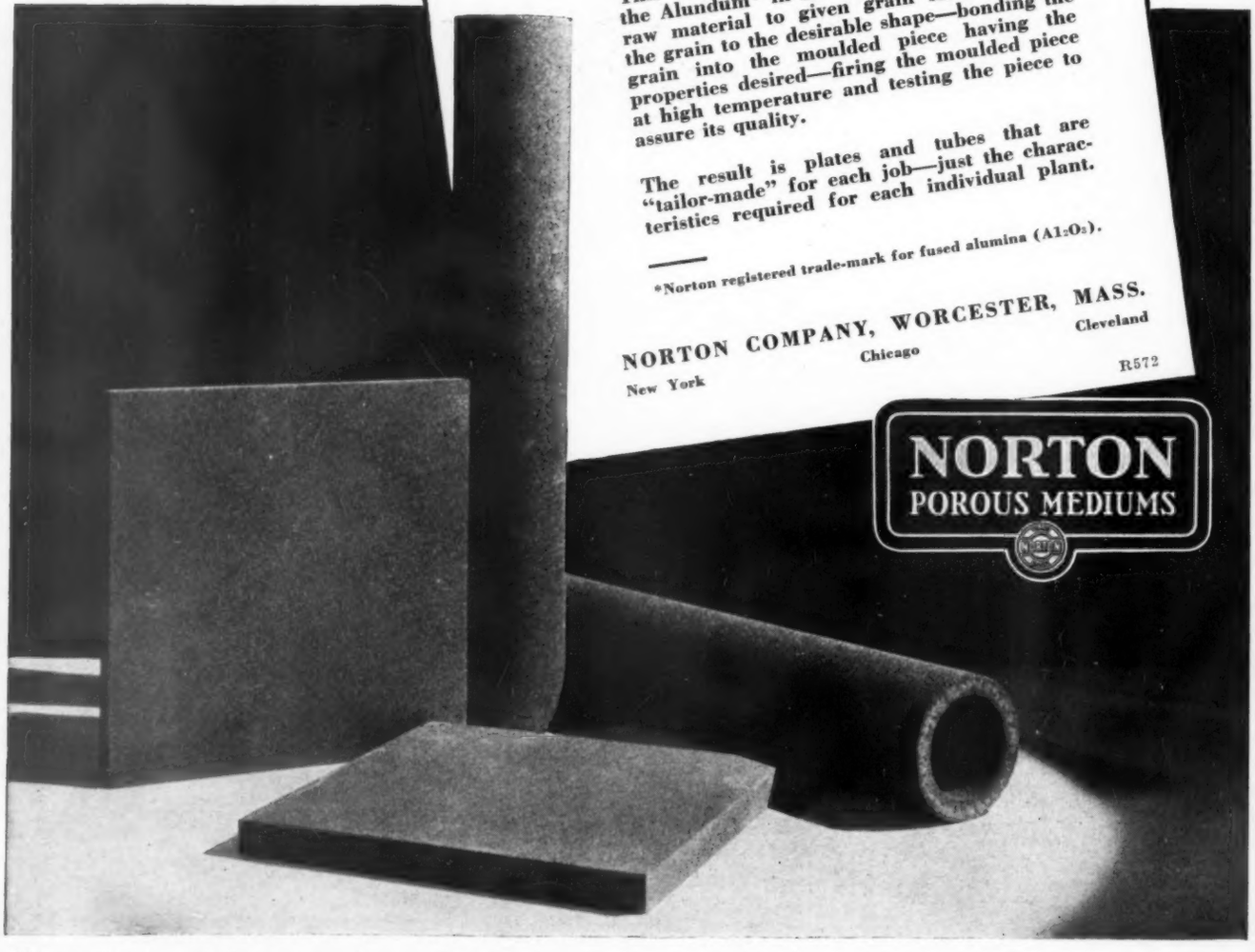
The result is plates and tubes that are "tailor-made" for each job—just the characteristics required for each individual plant.

*Norton registered trade-mark for fused alumina (Al_2O_3).

NORTON COMPANY, WORCESTER, MASS.

New York Chicago Cleveland

R572



EBG MAKES A CLEAN GETAWAY. . . FILLED TO EXACT NOMINAL WEIGHT. *When an EBG container is filled it is filled with care and precision. Exact weight is the rule. Precision, not only in this step but in every step in the handling and conditioning of containers, is one of the many ways by which we guarantee the uniform efficiency in operation for which EBG Liquid Chlorine is famous. A pure, clean and uniform product, we make sure that it makes a "clean getaway" in spotless containers from our plant to yours.*

•

ELECTRO BLEACHING GAS COMPANY
Main Office: 60 East 42nd Street, New York, N. Y.
Plant: Niagara Falls, N. Y.

EBG Liquid Chlorine
FIRST IN THE COUNTRY

Let's make medicine

the council fire is lit . . .

INTERESTING HOWS

HOW the Industrial Advertising Manager Can Function in His Public Relation Program.

HOW to Evaluate Publications—Methods of Qualitative and Quantitative Analysis

HOW to Use and Not to Use Industrial Motion Pictures

HOW to Develop and Maintain Industrial Mailing Lists

HOW to Secure Greater Effectiveness from the Advertising Dollar

HOW to Organize and Carry on Market Research Activities and How to Apply the Facts

HOW to Apply Showmanship and Add Sales Power to Industrial Copy

HOW to Write Better Letters and Use Them More Effectively

Prepared by The Buchen Company, Chicago

HOW! BROTHER

By smoke writing and carrier pigeon—by swift runner and heliograph, word has reached the council fire that the braves of many tribes are on the march and will assemble in full force at the big 15th Annual Pow-wow of the NIAA, September 22, 23, 24, at Chicago.

Important plans will be discussed—extensive exhibits of successful advertising and sales promotional material displayed and valuable "Hows" presented by industrial sales and advertising directors.

Of course, pleasure has had its full consideration—banquets, night clubs, bathing, golf—and bows and arrows for those who prefer.

Mr. H. D. Payne, Chairman, 2145 Walnut Street, Chicago, Ill., will gladly accept your reservation or send further information—write him.

NIAA

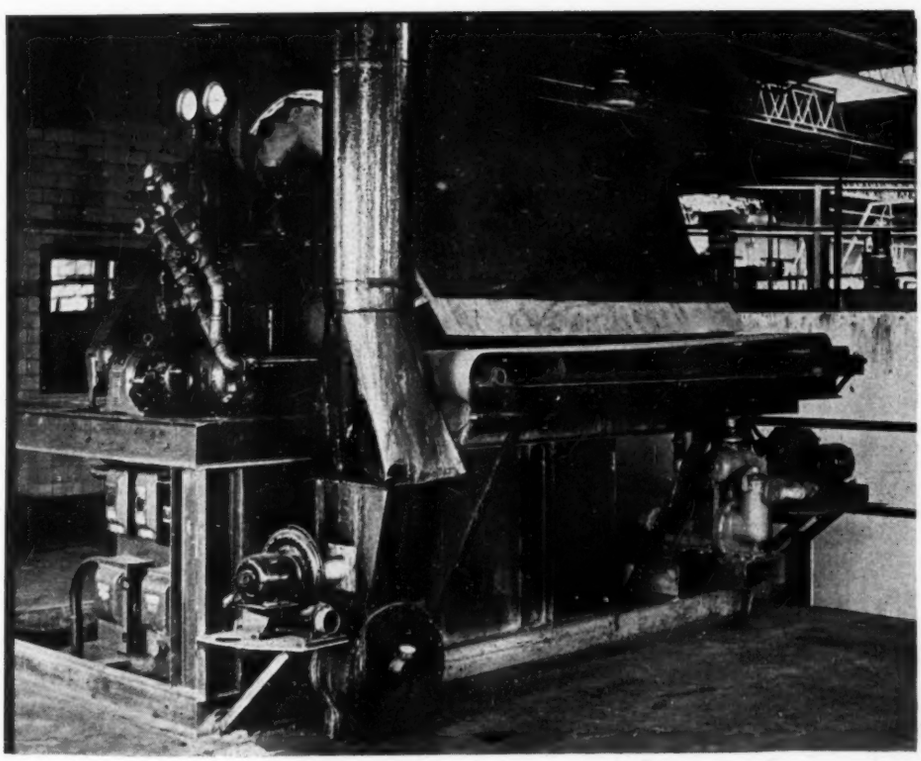
15TH ANNUAL ADVERTISING AND SALES PROMOTION CONFERENCE AND EXPOSITION
EDGEWATER BEACH HOTEL, CHICAGO
SEPTEMBER 22, 23, 24, 1937

65%

of the Cities and Towns using

OLIVER SLUDGE DEWATERERS

Have Flows Less Than 10 mgd



● This interesting fact concerning the Oliver United Sewage Sludge Dewatering installations rather knocks into a cocked hat the belief held by some that it is not practical for towns and small cities to use continuous mechanical sludge dewaterers.

These Oliver installations are most successful. They are compact, easily operated, almost entirely automatic. They remove from the sludge more than 99% of the suspended matter. Operations continue uniformly summer and winter alike.

Every small city or large town that wants to be up-to-date in its sludge-handling method should investigate fully the Oliver All-Assembled Sewage Sludge Dewaterer such as illustrated. It is the ideal unit for up to 2 mgd.

OLIVER UNITED FILTERS INC.

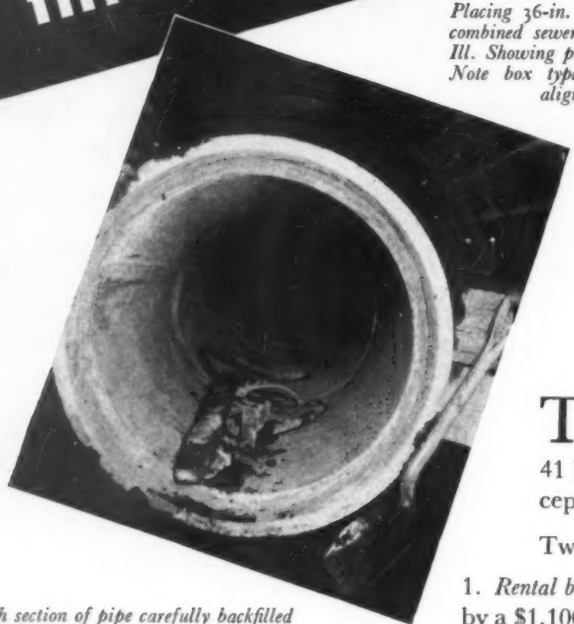
NEW YORK, N. Y.
33 West 42nd St.

CHICAGO, ILL.
221 N. LaSalle St.

SAN FRANCISCO, CAL.
351 California St.

RENTAL BONDS . . financed this PIPE-IN-TUNNEL project

Placing 36-in. reinforced concrete pipe combined sewer in tunnel, Oak Park, Ill. Showing pipe handling equipment. Note box type timbering—and good alignment of pipe



Each section of pipe carefully backfilled with foundation concrete

THE new concrete sewerage system in Oak Park, Ill., includes a 3-mile semi-horseshoe-shaped outfall ranging in section from 41 by 67 in. to 88 by 110 in. Also 6½ miles of concrete pipe interceptors and laterals, 24 to 42 in. in diameter.

Two facts make this program doubly interesting:

1. *Rental bonds solved financing.* The Village's share of the cost was financed by a $1,100,000 bond issue to be retired over a 20-year period by collections from property owners on a water consumption basis. Average cost to water users will be only about $8 per year each. The bonds found a ready market at a time when municipal financing was none too easy.

2. *Pipe laid in tunnel.* Of the 39,300 ft. of pipe, 19,230 ft. was built *in tunnel*, open cuts being used only where cut was less than 20 ft. deep to invert. Tunneling saved money over open cut construction, even for smaller size pipe, because there was less excavated material to dispose of during construction and because pavement cuts were avoided. The contractors, Michael Pontarelli, Inc., and M. J. Boyle, are enthusiastic over the ease, simplicity and economy of building concrete pipe lines by this method.

This work was completed under the direction of C. A. Walls, commissioner of public works, with village engineer William Thomas in charge.

American Concrete Pipe Association bulletin No. 11, "*Constructing Concrete Pipe Sewers in Tunnel*," will give you helpful facts on this subject. Includes advanced safety specifications of Wisconsin Industrial Commission, with numerous sketches and photographs of recent jobs. Sent free on request.

Another type of timbering used in Oak Park

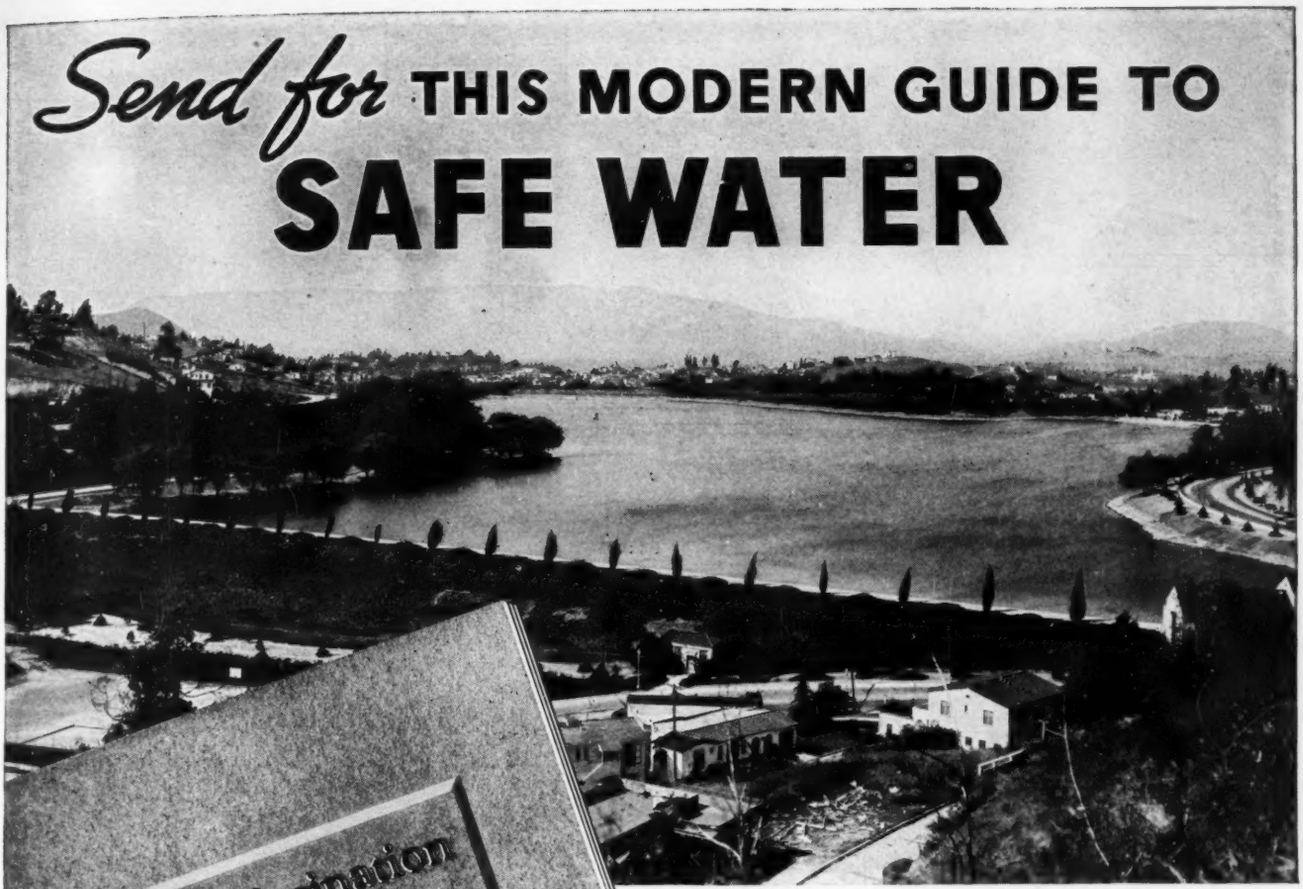
PORTLAND CEMENT ASSOCIATION

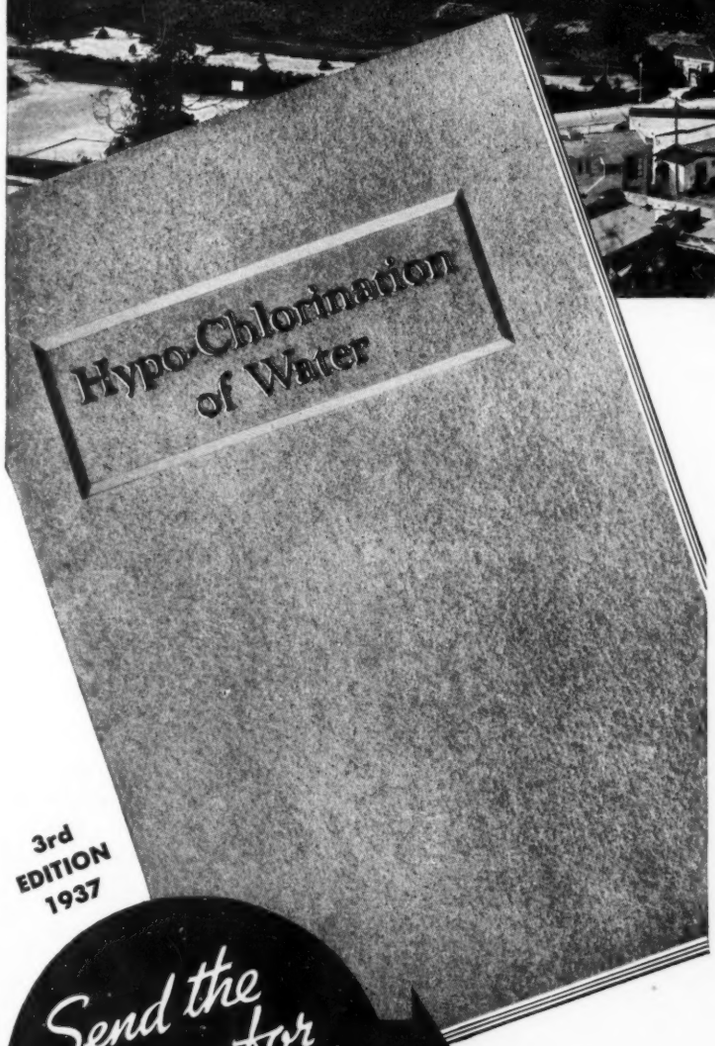
Dept. 8-29, 33 W. Grand Ave., Chicago, Illinois

A National Organization to Improve and Extend the Uses of Concrete

WHERE MILLIONS ARE AT STAKE SEWERS ARE BUILT OF CONCRETE

Send for THIS MODERN GUIDE TO SAFE WATER





3rd EDITION 1937

This valuable 72-page handbook gives modern answers to these old problems:

SAFEGUARDING smaller water supplies

COMBATING algae and slime growths

CONDITIONING filters, sterilizing filter sand

DISINFECTING new reservoirs, basins, tanks

STERILIZING water mains following construction or repair

FEEDING hypochlorite—selecting proper equipment

INSURING safety in emergencies

Every person who has to deal with the problems of supplying safe and wholesome drinking water will want a copy of this practical handbook. Use the coupon and send for your copy today.

The* MATHIESON ALKALI WORKS *(Inc.)
60 East 42nd Street **New York, N. Y.**

Soda Ash . . . Liquid Chlorine . . . Bicarbonate of Soda . . . HTH and HTH-15 . . . Caustic Soda . . . Bleaching Powder . . . Ammonia, Anhydrous and Aqua . . . PH-Plus (Fused Alkali) . . . Solid Carbon Dioxide . . . CCH (Industrial Hypochlorite)

Send the Coupon for this valuable handbook

THE MATHIESON ALKALI WORKS (Inc.), 60 East 42nd Street, New York, N. Y.
Yes, send me a copy of the 3rd Edition of "Hypo-Chlorination of Water" without cost or obligation.

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TITLE.....

COMPANY.....

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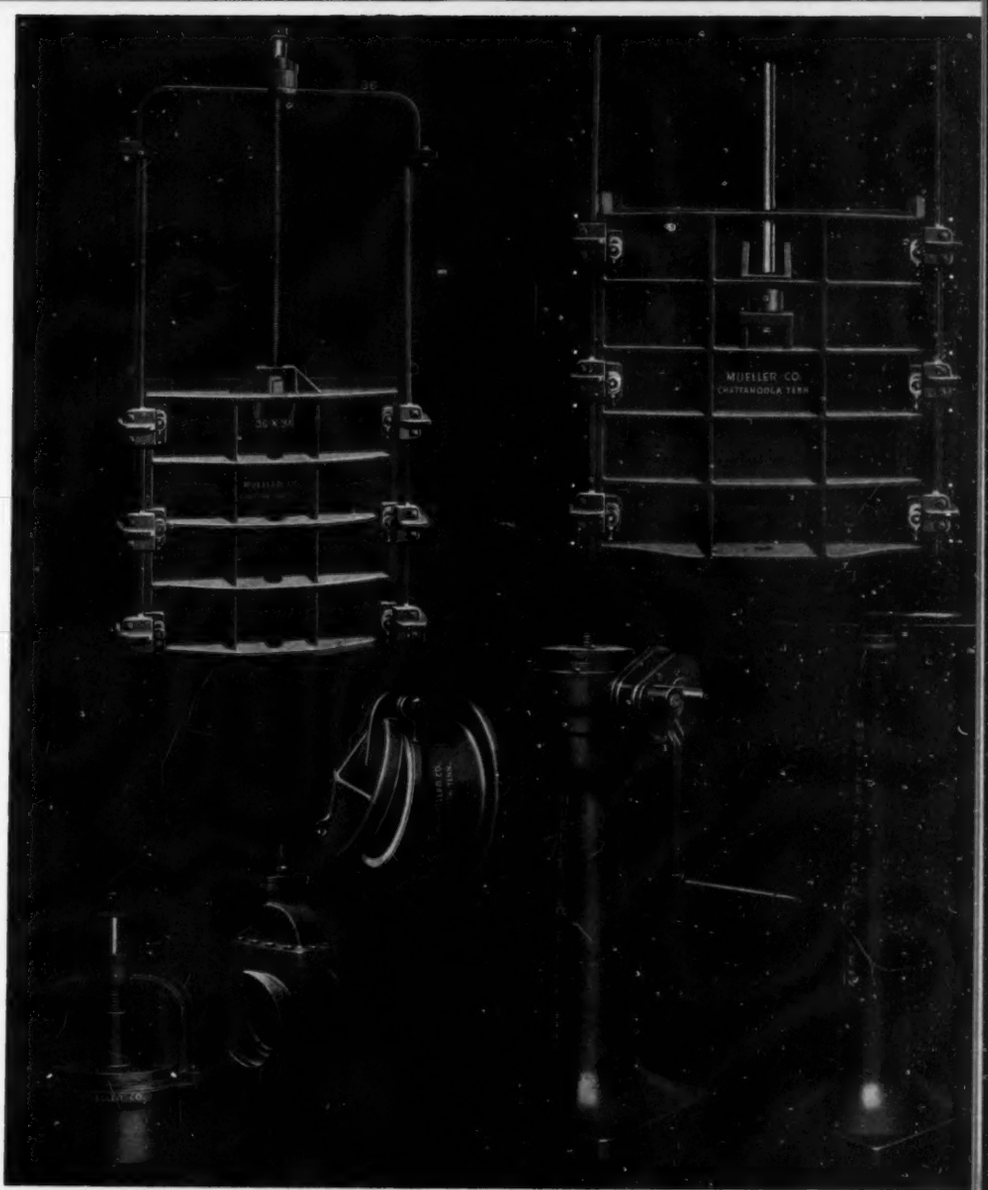
Supplying Essential Buying Information—Design, Specifications and Data on Installations on All Kinds of Waterworks and Sewerage Plant Equipment

COLUMBIA
Sewage Treatment Equipment Exclusively since 1893
P.F.T.
71 YEARS of WATER WORKS SERVICE
THE LUDLOW VALVE MFG. CO. TROY, N. Y.
THE JEFFREY MANUFACTURING COMPANY
GOLDEN-ANDERSON VALVE SPECIALTY CO.
THE EDSON CORPORATION
This Unique 300 Page Reference and Catalog Edition (May, 1937) Now Acting As Silent Salesman for 121 Manufacturers
WATER WORKS & SEWERAGE
WATER WORKS & SEWERAGE
Convention Number
MAY, 1937
See You in BUFFALO at the A.W.W.A. CONVENTION
PITTSBURGH EQUITABLE METER CO.
PITTSBURGH WATER METERS
REFERENCE and DATA SECTION
MAY 1937
EDITION
The Only Magazine of National Circulation (likewise an important foreign coverage) devoted to the two closely allied and interlocking fields.
WATERWORKS AND SEWERAGE
Published by Gillette Publishing Company
Publishers of
WATERWORKS & SEWERAGE
ROADS AND STREETS
MIDA'S CRITERION
SPORTING GOODS JOURNAL
OIL & SOAP
POWERS' ROAD & STREET CATALOG & DATA BOOK
Chicago
New York
San Francisco
Cleveland

MUELLER COLUMBIAN LINE

for
Sewage Disposal Plants
Filtration Plants
Pumping Stations
Power Projects

Sluice Gates Floor Stands Gate Hoists
Bench Stands Shear Gates Flap Valves Mud Valves
Gate Valves Check Valves Foot Valves



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WATER WORKS & SEWERAGE

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor

ARTICLES AND AUTHORS Scheduled for Future Issues

"Gas Engine Performance at Aurora, Ill.," is a contribution from Walter A. Sperry, Superintendent of the Aurora Sanitary Districts, which reveals a full 12 month record of the performance, efficiency and economy of the twin gas-engines, so successfully serving Aurora's sewage treatment plant. This article constitutes an outstanding presentation of facts and figures, which proves the wisdom of Aurora authorities in turning to sludge-gas engines as the source of power for pumping sewage. The discussion of what has been learned in respect to gas engine operation and maintenance, contains warnings, suggestions and recommendations of especial value to users and prospective users of gas engines. Mr. Sperry's financial statements read like those of a successful industrial plant manager, wherein the investment in a new machine is written off in the first two or three years through reduced manufacturing costs. Here is an article well worth studying—our regret being that we could not make use of it in this issue.

"Maintenance of Water Meters"—May have the sound of an oft told story. However, the axiom, **"As the meters go—so goes the revenue!"** sounded by the author of the forthcoming article, is so true that methods looking to better maintenance, and no let up in good maintenance practice, will always prove worthy of space in publications serving the water works industry. Those who have reviewed the material under "Meter Testing Repair and Maintenance," in the Reference and Data Section of our May issue, by **Clem A. Gallagher,** Louisville's Superintendent of Meters and Services, will need no urge to read his forthcoming article. In addition to the fact that this author "knows his meters"—he has the gift of being an easy writer, plus the willingness to give others the benefit of his experiences.

"What Cost Leaking Manholes?"—constitutes an account by **A. M. Rawn*,** Assistant Chief Engineer, Los Angeles County Sanitation Districts, of findings in a survey and study which revealed good and bad features of manhole cover design. In respect to leaking tops, grit entry and storm-water surcharging of sanitary sewers, the author reveals data which will prove surprising to most designing and operating engineers. Mr. Rawn's findings show the need of giving more attention to specifications covering manhole castings and cover design, than has been commonly considered warranted. (*Associate Editor, Water Works & Sewerage.)

"Some Unusual Features of the Water Treatment Plant of Elgin, Ill."—will be described by J. Albert Robinson (Chicago engineer) who, by his reasoning and design, shows that he believes that conservation and progressiveness need not be strangers in modern purification plant design. To many, the departing features will catalog the author as a fearless designer. All will be interested in these departures, denoting independent and aggressive engineering application.

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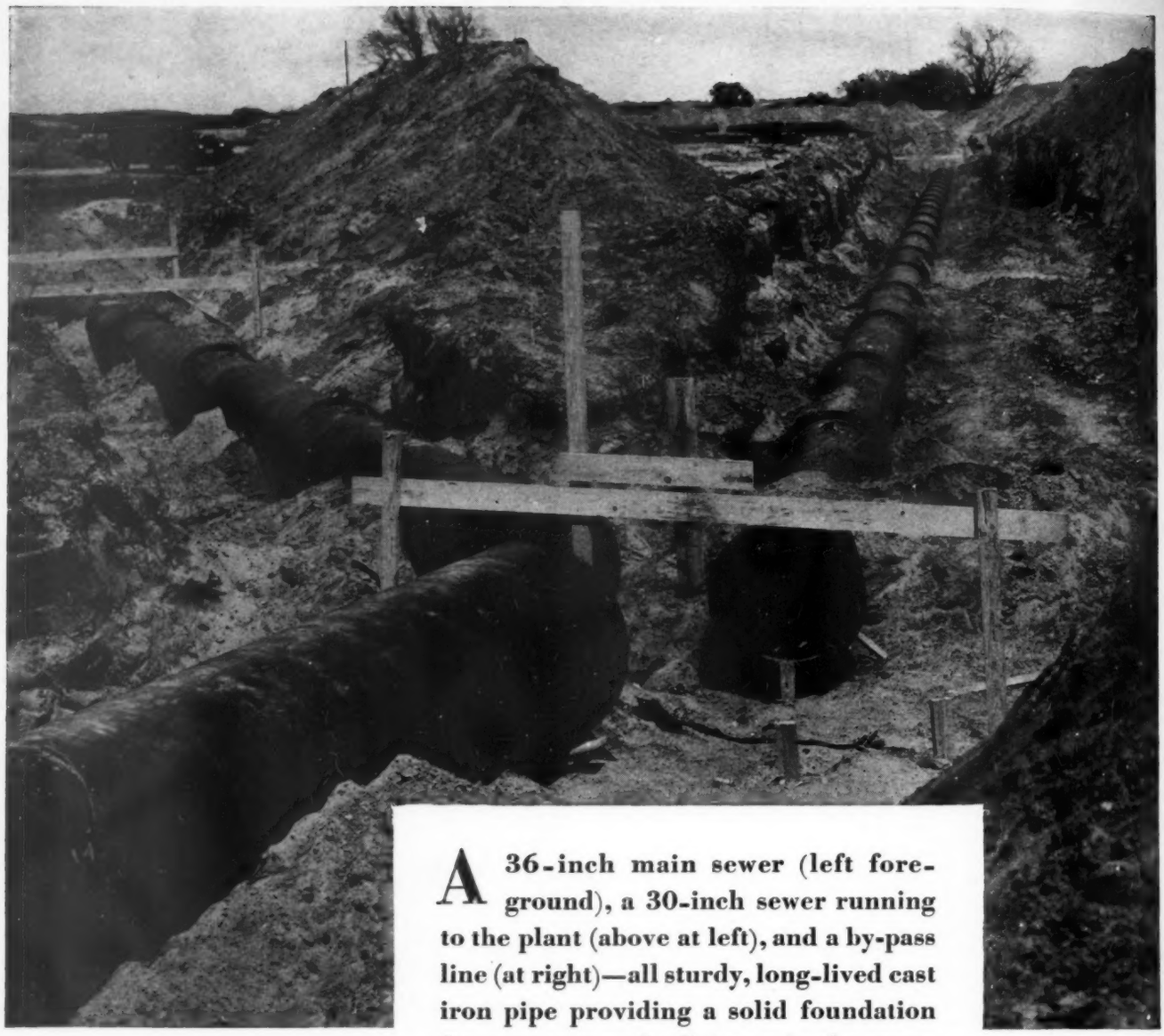

Installing cast iron pipe for new sewage treatment plant at Austin, Texas

A 36-inch main sewer (left foreground), a 30-inch sewer running to the plant (above at left), and a by-pass line (at right)—all sturdy, long-lived cast iron pipe providing a solid foundation for economy and efficiency in the operation of a new sewage treatment plant at Austin, Texas. The lines are infiltration-proof because the joints stay tight. And they are permanent because of the structural strength and corrosion-resistance of cast iron. For further information, write The Cast Iron Pipe Research Association, Thos. F. Wolfe, Research Engineer, 1013 Peoples Gas Building, Chicago, Illinois.

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WATER WORKS AND SEWERAGE
A GILLETTE PUBLICATION
VOL. 84 AUGUST, 1937 No. 8

FEATURES OF THE SEWAGE TREATMENT PLANT FOR DENVER, COLO.

By BERT F. STEVES*

Kansas City, Mo.

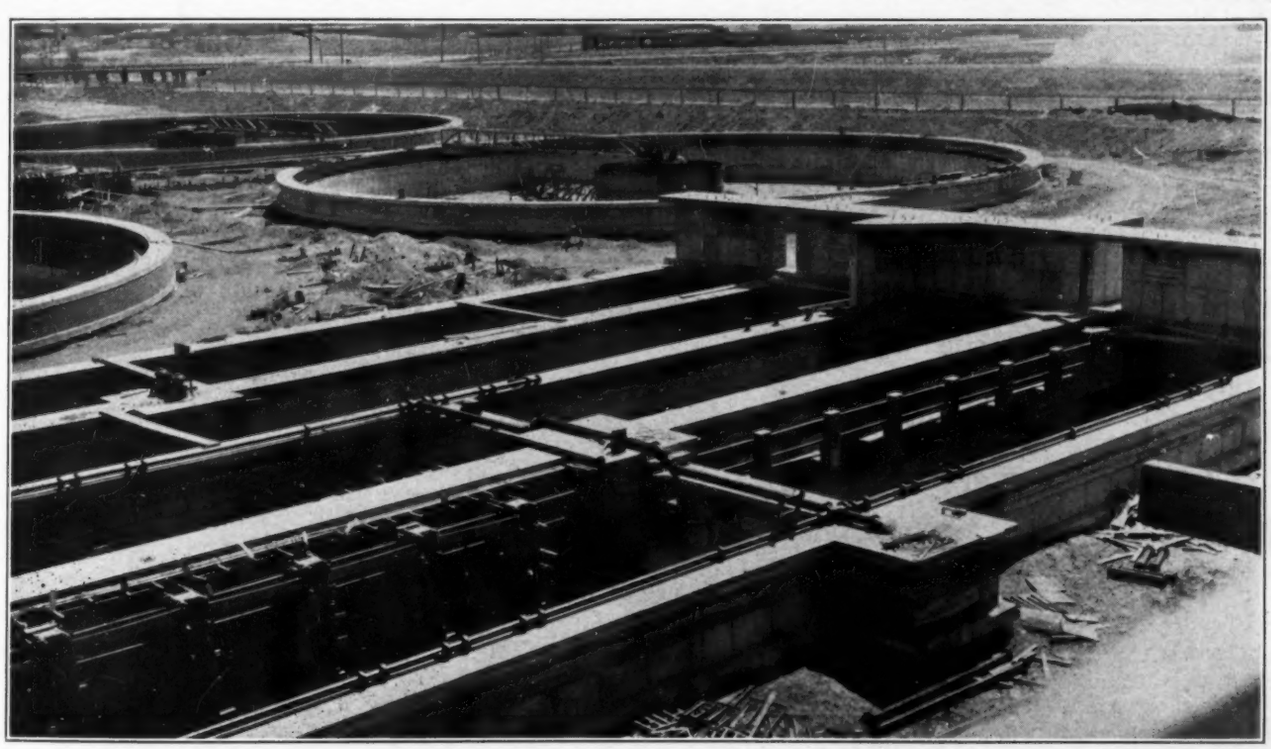
THE City of Denver is, at the present time, engaged in a comprehensive program for the abatement of the nuisances in the South Platte River, and irrigation systems fed therefrom, caused by the discharge of untreated sewage and industrial waste into the river. The program includes a system of trunk sewer extensions, the diversion of water from the western slope of the Rocky Mountains, to augment the natural dilution, and a mechanical-chemical sewage treatment plant. The sewer extensions are practically complete, contracts on the dilution water diversion project have been awarded, and construction on the treatment plant is considerably advanced. The following discussion deals only with the treatment plant.

*With Black & Veatch, Consulting Engineers, Kansas City, Mo.

Basis for Choosing Chemical Treatment

A study of the application of the several well-known types of plants to the problem of meeting the treatment requirements, resulted in the adoption of a plant to provide seasonal chemical precipitation and mechanical filtration. Primarily, the reason for such a choice lies in the flexibility of treatment control and the operating economies procurable with this type of plant. In addition, the effectiveness of iron salts in the elimination of plant odor nuisance constituted an important factor in the choice of process.

Even though the plant site is in a section of the city occupied by stock yards, meat packing industries and smelter operations, an attempt has been made to create an artificial, park-like atmosphere by incorporating in the



Denver's Combination Mixing-Grease Separating-Flocculating Units

The two-pass rapid-mix and grease-separation chamber is followed by the two-pass paddle-wheel flocculator beyond. For combination effect of air "sweetening," rapid-mix and grease separation, diffused air is employed in the near chambers. Accumulated grease foam is mechanically skimmed from the "grease-traps," running their entire length, and is pumped to the digesters.

design, a modernistic architectural treatment for the structures and the use of planned landscape architecture for the grounds.

Architecture

The site may be described as a very flat tract of land immediately adjacent to the river and at such an elevation that the entire area must be protected from extreme floods by a six-foot earth dike. The normal high water elevation is just one foot below the average elevation of the site. Sewage is carried through a system of collecting sewers to a main junction chamber, which is the plant control and by-pass structure. A 78-inch gravity line crosses the river as an elevated steel pipe line and enters the chamber from the east. This river crossing is constructed of rust resisting copper bearing steel. It is so designed, through the use of stiffener rings at appropriate spacings, that the pipe spans carries the sewage load as well as their own dead weight, thus making the two hundred foot crossing possible with only two spans and a center pier located in mid-stream. A 42-inch concrete pressure line enters the chamber from the southwest and a discharge line from a pump station, serving a small low lying district, enters from the west. The general arrangement of the plant structures is such that an artistic concentration of mass is obtained without interrupting any of the necessary features of direct manipulation of the sewage as it passes through the treatment process.

The danger of flood overflow and the elimination of the difficult and expensive ground water construction problem made it necessary to place the tops of all tanks, connecting flumes and building foundations at or above the top of the protecting dike. Since this plan resulted in a lack of sufficient excavated material to build embankments around all of the structures, the available fill material was concentrated in a mall in front of the Administration Building, level with the dike, and the rest of the site was graded level at an elevation three feet above the average ground line. This means that all of the structures and connecting flumes will be exposed for an average height of four and one-half feet above the finished grade. Therefore, some means of protection for these water bearing walls had to be provided. The choice of material to be so used is intimately related to the style of architecture for the plant buildings. Most of the buildings tie in with the tanks and flumes, and in order to carry a continuity of line and appearance from one building to another, the same material was used throughout.

A very interesting architectural treatment is obtained through the use of color in the building exteriors. All buildings, up to the corbel (which is at the same elevation as the top of the flume and tank walls), and likewise the flume walls, are faced with dark green glazed tile. Above the corbel, except for a trim at the tops of windows, doors and a top wall coping, all building exterior walls are faced with light gray glazed tile of the same quality.

To carry out the modernistic trend of the architectural design, all exterior light is admitted to the buildings through glass brick panels instead of ordinary window sash. The Administration Building and one exposure of the ground floor of the Chemical Building did not lend themselves to this treatment. The occupants of these two buildings must be able to observe the outside activity of operation readily. Architectural steel sash and industrial sash are used, respectively, for these two buildings. For ventilating those buildings having glass brick panels, instead of windows, adjustable louvres have been provided at the ends of each panel. This combination of light and ventilation results in a material saving in heat losses, a very serious consideration in a large building such as the Chemical Building; also, the small and only periodically occupied buildings, such as the Screen House or Filter Control Building. Aluminum is used extensively throughout the plant, on both interiors and exteriors. All of the louvre panel ventilators are made of it, and the entire front entrance of the Administration Building (transom, side lights, frame and door) are fabricated from aluminum shapes and plates. Normally the connecting flumes are covered with a concrete slab, but above each control gate an opening is provided for accessibility. These openings are fitted with aluminum bar gratings. Wherever possible, and still within the bounds of practicability, aluminum is used on the interiors of the buildings. This includes the housings of gauges and meters, ornamental handrail, and to some extent for metal trim. The entire treatment plant layout is designed to attract and interest the townspeople as well as out-of-town visitors.

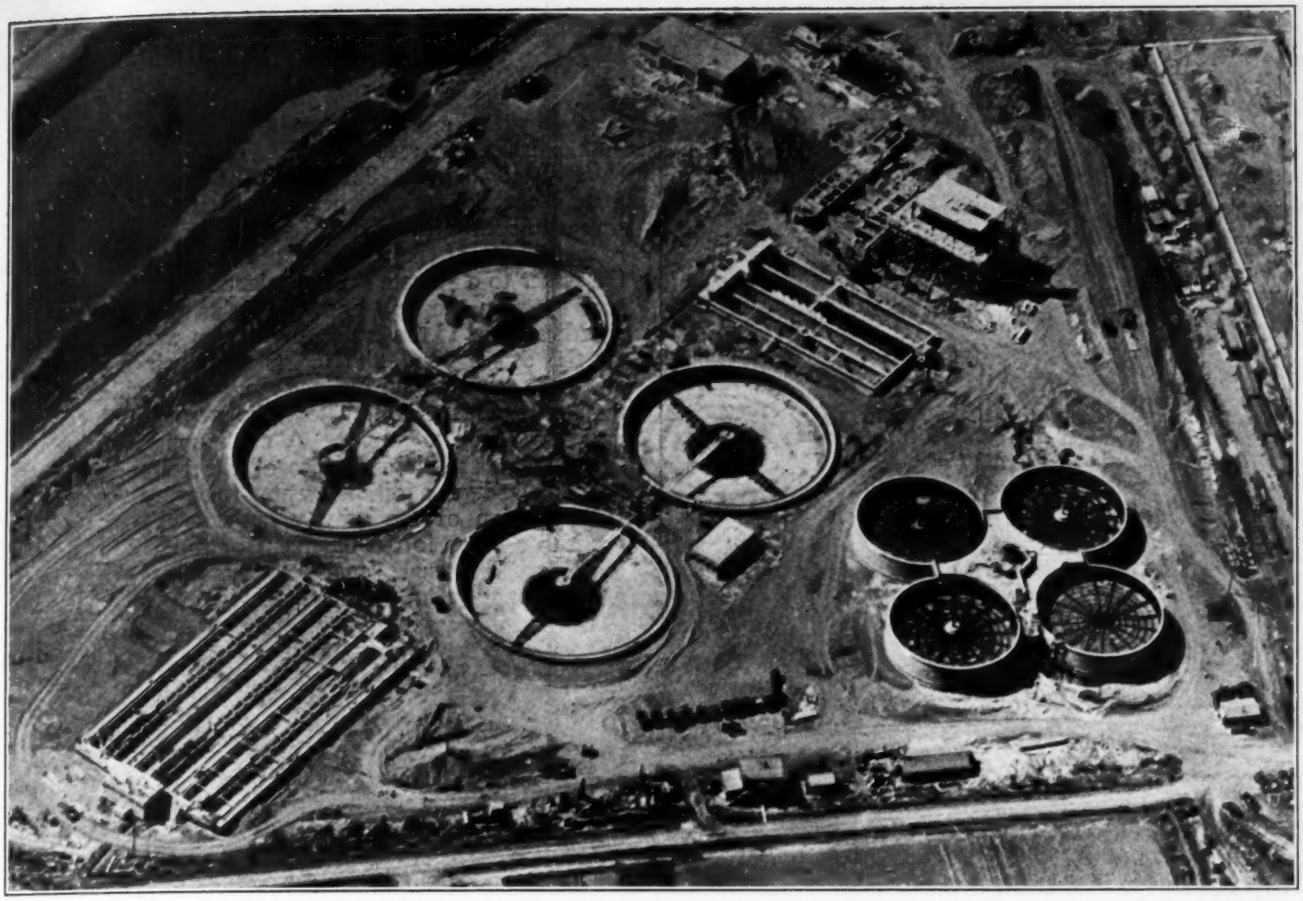
General Design Features

In general, all buildings and tank structures are supported by spread footings bearing on undisturbed soil. Footings are designed to distribute the loads at a uniform intensity of four tons per square foot. Exceptions to this design are found in the footings for the columns of the Chemical Building, where the unit bearing pressure was allowed to reach six tons per square foot, and the foundation design for the main Junction Structure. This last structure is on the river side of the protecting dike and is consequently subjected to the action of river currents. In this instance, 20 ton bearing piling is used, so that the structure will be stable no matter what the scour of the river might do. Some of the structures, in particular the mixing and flocculation basins, are founded well below the average ground water level. Where this is the case, the structures are either designed to withstand the full effect of the hydrostatic pressure, or else provision has been made for admitting the ground water when the tanks are empty.

Sewage enters the plant through the main Junction Structure which serves as the main plant control and by-pass. Electrically operated sluice gates provide the mechanical means for operation. The outlet of this structure at the bottom is a 72-inch concrete pressure pipe, which carries the sewage through the inlet venturi-meter to the Screen House. The venturi-meter, on which plant operation will be dependent, is equipped for electrical transmission to indicating and recording instruments, and for the operation of the automatic sewage sampling machines. The meter has a capacity range from the present minimum daily flow of 30 M.G.D. to an anticipated maximum of 110 M.G.D.

Screenings Shredded.—At the screen house the sewage divides equally between three five foot channels, each of which contains a mechanically cleaned bar screen. Each screen is equipped with a shredder, which discharges mascerated screenings to the sewage. Through the use of electrically operated sluice gates, each screen channel may be taken out of service, the capacity of the screens being such that the two remaining screens will handle the total flow.

The screened sewage flows through a side-overflow, weir type, by-pass and overflow chamber, the weirs of which are set at such an elevation that sewage will start by-passing to the river when the total flow is 60 M.G.D. The amount of sewage by-passed will increase as the total flow increases until the anticipated maximum of

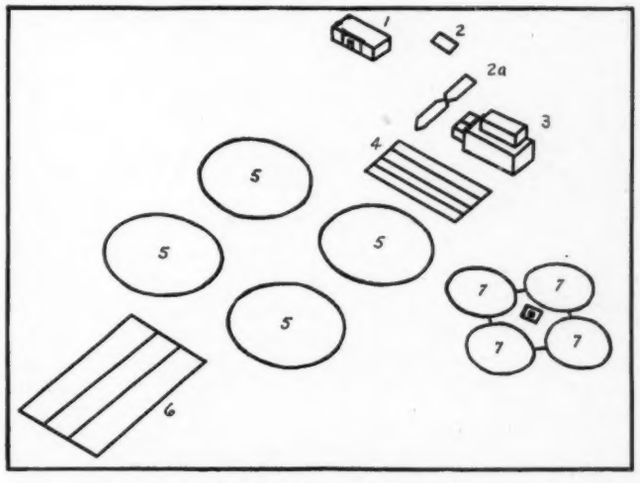


The Denver, Colo., Sewage Treatment Plant Takes Shape
Status of Construction May 20, 1937
(For identity of units see key sketch)

110 M.G.D. is reached, when the by-pass will be discharging 30 M.G.D. to the river. A maximum of 80 M.G.D. will go to the plant for treatment. An adjustable weir edge makes it possible to change these relations so that any maximum, from 60 M.G.D. to 90 M.G.D., may be taken through the plant and the remainder by-passed. An electrically operated auxiliary by-pass gate, capable of handling the entire sewage flow has also been provided as an emergency feature.

Course of the Sewage.—In consecutive order, the screened sewage is passed through the two parallel grit removal channels, each of which is equipped with a straight-line mechanical cleaning mechanisms; therefrom, through a two-pass chemical mixing basin, using air for initial mixing and grease and scum separation, constructed after the plan of the familiar "Manchester" type aeration tank; thence, to a two-pass flocculation basin equipped with paddle type mechanical agitators; and, into four settling basins of the central feed and peripheral overflow type. The tank effluent is filtered through magnetite sand type rapid filters, equipped with cleaning devices of the Laughlin type, and thence through another venturi-meter to the river outfall. The flow of the sewage, through all of the tanks and their connecting flumes, is controlled by electrically operated sluice gates, each of which is controlled from an individual push-button station mounted on the operating stands.

Course of Sludge and Scum.—Sludge from the four settling tanks, and grease and scum from the diffused air mixing basin, are pumped to the four digestion tanks, each of which is equipped with a floating cover

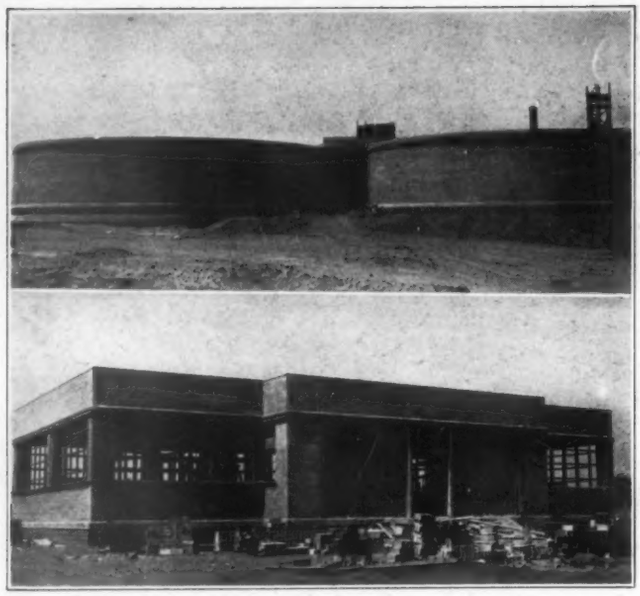


Key to Aerial Picture—Denver Plant

1—*Administration Bldg.*
2—*Screen House*
2a. .*Grit Basins*
3—*Chemical House and Iron Chloride Generator*
4—*Mixing Chamber and Flocculator*
5—*Clarifiers*
6—*Magnetic Filters*
7—*Digesters and Sludge Control House*

of the Downes type. The cover of one of the tanks is fitted with an extension rim and is designed to be used as a holder for the sludge gas.

Digested sludge will be air dried on natural sand beds. There are sixty-eight separate beds, each 80 ft. in width and 100 ft. in length, separated by a ridge of earth eighteen inches high. The beds are graded level and



Digesters and Administration Building
(Above)—Two of the cluster of four floating-cover sludge digesters, with main entrance to sludge control house in center. (Below)—Administration Bldg., as others, is finished in subdued green and light-gray tile, with aluminum metal doorway and trim.

the finished surface is the natural soil. Due to the porosity of the soil, no under-drainage system has been provided. Dried sludge will be hand removed from the beds and deposited on a traveling belt conveyor which discharges into trucks or on stock piles along the sides of the sludge bed area.

Chemical Building.—The Chemical Building houses the chemical storage tanks, dry feed machines, chlorinators, chlorine storage racks, a machine shop, blowers for the mixing basin air supply, the pneumatic conveyor system for handling bulk chemicals and a shower and locker room. Outside and attached to the end of the building, near the grit removal basin, is the battery of concrete tanks for producing ferrous chloride solution. Such solution, in whole or in part, will be chlorinated (en route) to produce ferric chloride to the extent desired or found advantageous. The chemical solutions are fed into vitrified clay-lined ducts which discharge into the main sewage flume near the entrance to the mixing basin.

The plant operations are directed from the Administration Building which contains offices for the plant superintendent and the chemist, a room for general operations and the various recording meters and gauges, and a fully equipped laboratory. The basement is arranged to provide space for a boiler room, a storage room and a two-car garage.

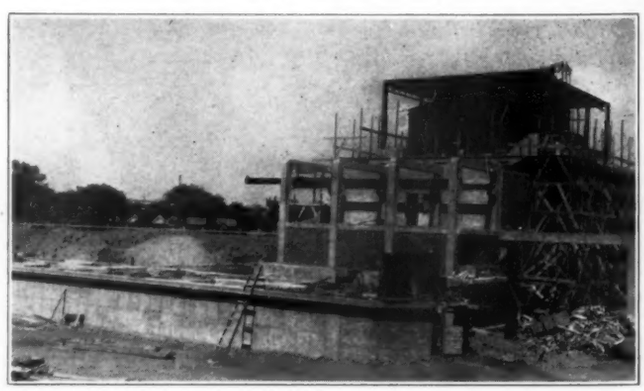
Special Problems

There are no unorthodox or freak structural designs incorporated in the various structures, although several very interesting problems were encountered, the solutions of which are worthy of note.

One problem, of a mechanical nature, was the removal of grease and scum from the water surface in the combination grease separation and mixing chambers. The solution involves the use of the rolling motion imparted to the sewage by the air in a "Manchester" type tank. The air bubbles tend to separate the scum and grease particles from the sewage and raises them to the surface. Once on the surface the rolling action carries these particles to the side of the tank where the skimming mechanism is installed. The skimmer is a continuous flight conveyor with wood flights, 2 ft. 6 in. wide and 1 ft. high, attached to the drag chains at their vertical centers. The flights are set to skim to depths, ranging from three inches to twelve inches, depending on the hydraulic gradient produced by the sewage flow. At the maximum rate of 80 M.G.D. the flights will be entirely submerged. This condition will last approximately one hour and, when the water level drops, the trapped floating material will be removed as usual. The return flights of the conveyor are carried entirely above the water to eliminate the turbulence that would be created between the two lines of flights moving in opposite directions, if the entire mechanism were submerged. At the driving end, the flights and their accumulated loads are raised up an inclined trough to a sill above the maximum water level, where the grease and scum is discharged into a hopper. A continuous high velocity spray keeps the sloping sides of the hopper clean and provides enough additional water to insure the successful operation of the gravity outlet which carries the scum to a sump in the basement of the Sludge Control building. The final disposal of this material is accomplished by pumping it into the sludge digestion tanks.

During the design of the mechanical filter units an interesting economic study developed. As the only substantial experimental data on filters, used in connection with sewage treatment, is based on the mechanically cleaned, thin sand bed type, it was desired that some methods be devised for economically measuring the cost to be included in the filter unit. Reasoning that if a standard water filter of the rapid sand type, with its rate stepped up to 4 gal. per sq. ft. per min., could be included in the plans, the result would be a yard stick by which the value of a mechanically cleaned filter could be measured. The design, construction and operation of this familiar type of filter has become a routine procedure and abundant cost data for such installations are easily obtained. All available data derived from experiments with this type of filter, when used for filtering sewage, indicated a justification for the belief that, when following a chemical precipitation type of primary treatment, the filter would operate successfully with but one wash a day.

Such a filter was designed and included in the plans to provide the necessary competition in bidding. The filters were to be uncovered and arranged in two rows of five 8 M.G.D. units each with a covered pipe gallery in the center. Filter effluent was to be pumped to an elevated steel tank for wash water and the wash waste was to be pumped to the inlet of the mixing basin. In order to compare favorably with the automatic features of the mechanically cleaned filter, all control valves



The Chemical Building Takes Form
(In the middle-ground are the overhead crane equipped scrap iron chambers for generating ferrous chloride by the continuous method for conversion to ferric chloride to the extent desired.)

were to be electrically operated, from a remote control switchboard, in the control building which was located at one end of the filters. The result of this plan proved entirely satisfactory as there was active and spirited competition between the manufacturers of the two types of filter equipment. It cannot be said that this one letting is conclusive evidence as to the relative cost of the two types of filters; but, it is an indication that the same plan can, with profit, be followed on other designs when the use of filters is anticipated.

All equipment necessary for the complete control of the sludge digestion process is housed in the building created by enclosing the area between the four digestion tanks. This equipment includes the sludge piping and sampling sinks, gas collection and distribution header piping, gas meters, liquid level gauges, recording thermometers, hot water boilers for the hot water circulating system of heating the sludge in the tanks, ventilating fans, and all other equipment incidental to proper operation.

The structural design of this building is interesting in that it is designed as a self supporting unit allowing the four tanks to act as independent structures. Even the basement floor is separated from the tank footings by means of an expansion joint and the only part of the building structure, that is constructed monolithically with the tanks, are the footings for the row of columns along the circumference of the tank walls. Expansion joint material is used at the roof line and along the vertical joints, between the building and walls and the tanks, to provide for movement as well as weatherproofing.

The design of the circular tank walls and especially the digestion tank walls is based on the theory of analysis as published by Laverne Leeper in *Civil Engineering* for November, 1933. This theory has proved to be satisfactory in practice. Experience has shown that it results in the use of less reinforcing steel than some of the other designs. The digestion tanks are of such proportions (85 ft. in diameter and 30 ft. high) that the application of this analysis is typical, while for the settling tanks, with a diameter of 140 ft. and a wall height of only 9½ ft., the analysis resolves into a pure cantilever wall design.

Due to the wide variations in temperature experienced in the Denver climate, extreme care has been exercised on the location and spacing of expansion joints. Wherever possible, or wherever there was a choice, cantilever construction was adopted, since this type of construction is readily adaptable to any expansion joint requirements. All such joints are provided with copper bellows strips to assure water tightness.

There are a few special problems of a minor nature, that are interesting, but do not deserve more than their mention here. Among them is the continuous lintel detail, hung from the floor system above or the roof system, for spanning the wide openings occupied by the glass brick panels; the several oddities in construction made necessary by the modernistic architectural details; the removal of floating material trapped in the main junction structure and others of similar nature.

The entire project is under construction as a P.W.A. project at a total contract cost of $1,276,043.00. The construction work is being done by the Peter Kiewit Sons Company, Omaha, Nebraska, under the direct supervision of Mr. A. K. Vickery, City Engineer of Denver.

The treatment plant was designed by Black and Veatch, Consulting Engineers, Kansas City, Missouri.

Dorr Co. Shows New Research Edifice at Westport Mill

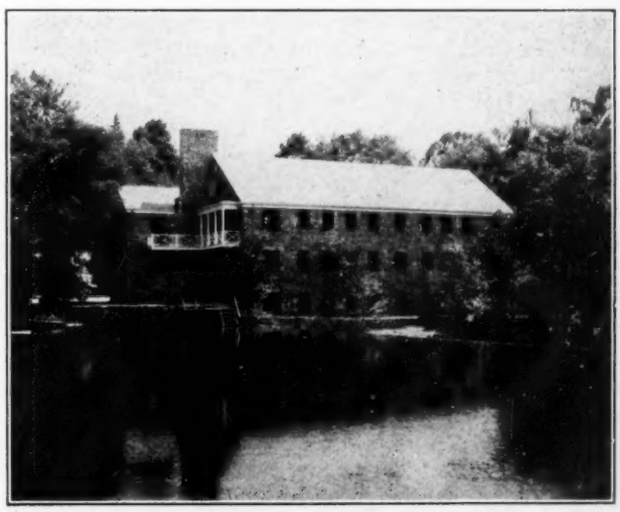
About 200 Engineers Came to See Demonstrations

Twenty years ago, J. V. N. Dorr purchased historic "Westport Mill," near Westport, Conn.; also, the mill-pond that drove its picturesque wheel, and a surrounding 50-acre tract. This successful pioneering developer and manufacturer of mining equipment, later industrial and, more recently, sanitation equipment, was not buying a curio or an antique to add to his collection. He foresaw the advantages of establishing a research and development station in quiet and peaceful surroundings away from the hustle and bustle of the metropolitan area, with its many distractions. So, in 1917 old revolutionary "Westport Mill," once a cotton mill, later a grist-mill, became a modern research and testing station, serving the Dorr organization within commuting distance of company headquarters offices in New York City.

The old-mill (of wood construction) burned, but on its stone foundations has risen a larger building of native stone in the beauty-spot, which the accompanying picture reveals it to be in its setting across the mill-pond. Within a mile or two the entire Westport Mill research staff live and Mr. Dorr's residence estate is likewise within walking distance.

On July 30th (a pleasant day in the country) the new laboratories and testing station, capable of semi-commercial scale testing of several processes simultaneously, was demonstrated to about 200 engineers and chemists after a pleasing luncheon served them on the grounds across the pond. The balance of the afternoon was devoted to tennis, golfing, canoeing and swimming. All around it was a delightful day, and an inspiration to see what goes on within the walls of busy, if peaceful looking, "Westport Mill" with its modern research and testing equipment, backed by a new machine shop, and on the upper floor a large library overlooking the pond.

Whose office is that opening on the corner balcony? Well, one could hardly blame the president of the company for picking that spot for his own—it's Mr. Dorr's, as often as he finds the chance to use it. Uppermost in this writer's mind was the thought—What a spot for the office of an editor! But, after all, "Ye Ed" has far to go to be a J. V. N. Dorr.



"Westport Mill"

1937 A.W.W.A. CONVENTION SETS A PACE

*Second Installment of Proceedings**

THE first installment of our report, covering the highly successful and record-establishing 57th Annual Convention of the American Water Works Association, held in Buffalo, N. Y., June 7-11, appeared in our July issue.

Here follows a continued presentation of the highlights of papers read and the discussion ensuing.

E. V. Buchanan, Mgr. Utilities, London, Ont. (Sec'y P. M. & O. Div.; Chm. Canadian Section)

Geo. Prindle, Supt. Highland Park, Ill. (Director, P. M. & O. Div.)

Water Allocation—Interstate Agreements

"The Future of Water Allocation, and Developments in Inter-State Agreements," by DUANE E. MINARD, Attorney at Law, Newark, N. J.

Mr. Minard, enriched through service in connection with the suit brought by Pennsylvania and New Jersey to limit New York's taking of water from the headwaters of the Delaware River, discussed his topic as a close student of the subject. Obviously, in this space, Mr. Minard's presentation cannot be covered adequately. Read in his absence, his paper presented a concise review of the cases of New York City and Boston, Mass., and the conclusions reached by the U. S. Supreme Court in allocating to each city waters which normally flowed into rivers in other states. Mr. Minard explained that such decisions were founded wholly on the takings of water for the "highest use"—namely, that of municipal supply. These awards, having been determined on merits of the individual cases, had nowise revoked the long revered common law, as applied to riparian rights, which had come to us from England. He commented that, in contrast, the common law in western areas of America (where irrigation had become a "highest use") recognized waters of streams to be the property of the first user. The two important eastern stream diversion cases had been decided on the grounds of insufficiency of proof that future damage would be felt by the plaintiff states (Pennsylvania, New Jersey and Connecticut). The basic policy followed was that of equitable apportionment, including a degree of stream regulation by the takers.

Mr. Minard, basing his remarks on first-hand experience, stated that in reaching agreements and setting up compacts, so-called expert testimony and technical experts "gummed the works." What was needed in allocating waters and deciding on usage of streams were cosmopolitan commissions, including "technical statesmen" who could evaluate political and social considerations as well as the technical aspects. In his opinion the country sorely needed a Federal plan, with state groups to carry out that plan. Such a combination would appear to have less weakness than interstate compacts or other considered methods of regulating water takings and controlling the use of streams.

COL. W. T. CHEVALIER, discussor, saw the future of water control as a possible parallel to the Federal aid plan in securing improved highway systems in the various states. He was 100 per cent in accord with the ideals of Minard, but his "technical statesmen" could not, in his belief, be responsive to the political aspects without dangers of technical unsoundness. The important factor in the Federal agency and leadership was to have the personnel free from pressure, interference, limitations. Therefore, to insure competency and freedom, appointments should cover more than two administrations. Col. Chevalier believed that a new type of technical administration must be bred if the Minard proposal was to succeed. He pleaded that somebody speak a voice in the proper and effective direction promptly.

ABEL WOLMAN, scheduled to present **"A Review of the Work of the National Resources Committee and the Status of Anti-Pollution Control,"** turned in his paper unread, because of the lateness of the hour. (The reader of the Minard paper, with his aside comments, was responsible for the inconsiderate over-running of the allotted time on the program—regrettably, in the face of repeated reminders of the presiding officer.—Ed.) Mr. Wolman, utilizing the remaining few minutes in discussing the Minard paper and replying to Col. Chevalier, said that he was at present in the interesting position of being at one time a municipal, a state and a federal employee. He questioned that appointment of a matured person to any board would change prejudices evolved during previous years of experience. Observation would reveal a decade or two as the period usually required to change the opinions of average normal indi-

Fighters of the Flood

L. S. Vance, Louisville Chief Water Engr.
L. A. Geupel, Evansville's City Engr.
A. S. Hibbs, Cincinnati's Water Supt.

*We regret that lack of space makes it impossible to print most of the section of this report which deals with Water Purification Division topics. A third installment, necessitated thereby, will appear in our next issue.—Ed.

viduals. The Federal plan, now under consideration, embraced attempts at integration and coordination alone. There existed no link of sufficient solidity between the actions of the several states and the Federal government. Considering the drainage basin (regional) plan, if taken alone, it did not appear sufficient in all water problems. In the order of efficiency the military method probably outranked the "central authority" process. But the latter, not so rapid or efficient, had the advantage of being more thoughtful and, therefore, more lasting. Replying to Chevalier, it was Wolman's belief that something of the political procedure was necessary for efficiencies. He thought the statesman had the right to ask the technical expert to prove his claims of adequacy, or need, at any stage. Not overlooking the value of technological advancement and technical adequacy, another matter recalled by Wolman was that "we are, after all, working with people." (Mr. Wolman's unread paper will assumedly appear in an early issue of the Journal of A.W.W.A., and will not be presented piecemeal here.—Ed.)

"International and Interstate Pollution Problems," as discussed by J. K. HOSKINS, Engineer in Charge, U. S. Public Health Service Station, Cincinnati, Ohio, constituted a review of the history of anti-pollution treaties between Canada, the United States, Mexico. Although a Federal problem, remedial measures to reduce boundary water pollution had always been left entirely in the hands of the individual states. Detroit, with a program involving primary treatment and chlorination of its 425 m.g.d. of sewage; Buffalo, building plants to provide a like treatment of its entire sewage; Niagara Falls, completing its plant to provide mechanical filtration (straining) with chlorination, would leave no major city on the Great Lakes without sewage treatment. In interstate or intrastate pollution, many cases revealed the need for revision of standards of treatment works effluents. Industrial wastes had now come to be the most important problem in many sections. The most seriously affected area was that 14 per cent of the nation north of the Ohio and east of the Mississippi where industrial development was the greatest, 65 per cent of the nation's population was to be found, plus industrial wastes approximately equivalent to sewage from an equal population in addition. In solving the stream pollution problem it seemed a basic consideration, and sound economics, that the minimum degree of treatment required for each water course must be established and state policies set up looking toward a measure of uniformity therewith. Cooperative programs between individual states, and state treaties, had their weaknesses; not overlooking that progress made by the Ohio River Board and the Great Lakes Board. A treaty looking toward cleaning up water ways between states had been recently set up between New York and New Jersey, with Connecticut expected to join. Even a newer anti-pollution commission was the Delaware River Commission. Mr. Hoskins cited the long drawn out and expensive litigation in Chicago's pollution (lake diversion) case, wherein the courts placed the burden of proof on the plaintiff states and Canadian interests. Time and money saving data were not available in form to speed the case.

The proposed Federal plan looking toward evaluation, integration and coordination in stream cleansing, was covered in the Barkley-Vinson Bill which has already passed the lower houses of the Congress. It embraced a 10-year program of pollution control, charging the U. S. Public Health Service with its administration. Involved was a provision for making grants to public bodies and low interest loans to private industry, to make less burdensome sewage and waste treatment.

Reviewers

Louis R. Howson, Alvord, Burdick & Howson, Chicago

Paul Hansen, Greeley & Hansen, Chicago

A. E. BERRY, Chief Engineer, Ontario Department of Health, explained that inter-provincial pollution problems do not exist in Canada. With power of regulation of industrial pollution as well as municipal, Canadian authorities would hardly be content to lag behind its sister country in anti-pollution developments. He referred to recent studies of industrial pollution of the Welland Canal and recommendations covering remedial measures. For pollution correction no government grants had been made in Canada; none were contemplated.

S. A. GREELEY, Chicago Consulting Engineer, recorded the fact that not less than 31 sewage treatment plants of major importance were soon to be completed in the United States; standards of treatment at others were being constantly raised. Experience emphasized (1) the great need for standards of treatment with universal acceptance and application; (2) the necessity of securing public interest and a method of financing, in the reach of all.

C. A. HOLMQUIST, Chief Engineer, New York Department of Health, briefly reviewed the New York-New Jersey-Connecticut compact and the work of the resultant Tri-State Commission which had been functioning since July, 1936. Interestingly, it had set standards for effluents into tidal waters lower than those previously considered requisite.

Progress Reviews

"Progress and Developments in Water Supply During the Year" was reviewed in separate papers by LOUIS R. HOWSON and PAUL HANSEN, both well known Chicago Consulting Engineers.

Part I—"Reservoirs, Supply Lines, Pumping"—L. R. HOWSON.

Concerning dams, Mr. Howson pointed to the continuing progress in technical supervision and control in grading, moisture control, and machine packing of earth fill dams, wherein advances in mechanization had been especially notable. More thought had been given spillway design, in view of the fact that almost every failure had been traced to some deficiency in that quarter. The Denver dam had been rolled compact in 6-inch layers. The rock-fill Colorado Springs dam was being constructed with a welded ¼-inch steel-plate facing, laid on the gravel-faced dam. In distribution storage, elevated tanks of large capacity were meeting with growing favor; there now being more than 60 such tanks, in sizes between one and two million gallons. Kenosha, Wis., had possibly the largest single tank, with 3,000,000 gallons capacity.

Noteworthy was America's first municipally built industrial water supply project at Birmingham, Ala.,

Chas. M. Roos, Mgr. Cairo (Ill.) Water Company (America's No. 1 "Sand-Boil Doctor")

Victor Weir, Supt. St. Louis County Water Co. (A creditable job as Division Chairman)

involving long lengths of bitumastic coated and lined light-wall steel pipe, jointed with Dresser couplings. In supply line design the modern trend had been toward the purchase of guaranteed capacity in dollars per year average cost, and calling for bids on alternate materials on this basis. On this score steel pipe, protected and lined with modern coal tar base enamels, had become competitive with concrete and cement lined pipes. This, because of its life expectancy and sustained high friction coefficient and predictable capacity after years of service.

Automatic cone-type valves had been more generally used to minimize line-break damage and line-surge, and were believed applicable to feeder mains also. On reservoir systems automatic pressure control valves were being more generally utilized. Concerning pumps, the only major development had been that in connection with the lifting of the Colorado River water into the Southern California Metropolitan Aqueduct. The design, involving unusually heavy rigid shafting and pump-case, to make feasible and economical a single lift of 400 feet, represented departures which would not be without effect on future pump design.

Part II — "Treatment and Purification" — PAUL HANSEN.

Somewhat back of a year went Mr. Hansen in his review, but this digest cannot reach beyond the newer and most important of the developments. The largest purification plant under construction is that at Milwaukee, Wis. (200 m.g.d.). During the year, 130 treatment plants have been completed, 90 being for softening, or iron and manganese removal. Two more of the successful Morse all-steel filter plants had been constructed. Mr. Hansen referred to the further improved broadcasting method of powdered copper sulphate applications to the surface of Los Angeles' reservoirs; to the continued and advancing use of chlorinated-copperas as an effective economy producing coagulant; increased adaptation and economy of mechanical flocculating devices; the use of absorbent clays to assist coagulation and remove tastes and odors; the work of Baylis at Chicago with silicates to enhance flocculation and coagulant economy; the installation of granular carbon beds for insuring taste and odor removal without cessation at Oshkosh and Neenah, Wis., and subject to use assisted by powdered carbon, applied as "shock troops" ahead of the sand filters, during periods of severe conditions.

Concerning filter design, he cited the effectiveness of sand scour and wash economy with the Baylis scheme of surface wash, now proven in a number of plants; advantages reported for "anthrafilt," where substituted for sand; revival of interest in Wheeler type false bottoms (pyramids filled with clay balls); the porous filter bottom of "Aloxite" plates, wherein the gravel bed is eliminated—citing Denver experiences over a 9-month period (see WATER WORKS AND SEWERAGE, March, 1937—Ripple, p. 84); the magnetite self-cleaning filter, experimentally studied at Portland, Me., for algae and amorphous matter removal; the trend toward coarser grained filter media—to wit, the new Springfield, Ill., softening plant utilizing sand of 1 m.m. size.

Concerning softening, there was not much new to report. Interesting was the scheme of Spaulding at Springfield wherein the treated water passed through "precipitators," involving the introduction of the treated water beneath the sludge to flow upwards through a precipitate cloud. (Has the sound of a revival of an early method of improving softening reactions and decolloidation of the treated water.—Ed.) Iron and manganese removal was receiving more attention—the zeolite method, and automatic control, becoming more widely used. Interesting was the method reported by Hale on a Long Island water, which involved lime precipitation (without aeration) and filtration out of the ferrous hydroxide precipitate through pressure units. Fluoride removal by softening reactions had proved effective on Ohio waters containing not more than 3.5 ppm. F.—waters lacking the magnesium required having magnesium salt added to produce the effective magnesium hydroxide precipitate.

In corrosion and tuberculation control the work of Hoover at Columbus had shown that for hot water systems other factors than pH value and depositing of calcium film had to be considered. The Utica experiences with ammonia-chlorine treatment, to maintain residual chlorine for suppressing tuberculation, continued to prove the sterilization method effective for the type of tuberculation encountered; in like manner, water deterioration and biological corrosion in distribution mains had been checked by maintaining chloramine residuals all through the system. As to general chlorination, 300 new installations went in during the year and more automatic chlorinators were being used, including the almost human Los Angeles' residual chlorinators. Super-chlorination, and de-chlorination with carbon at the filters, had been receiving more attention in taste and odor control and had proved efficacious and more economical in carbon requirement. For algae control, chlorine in combination with copper sulphate had been overall more effective than either alone, in certain cases.

Flood Experiences

(B. V. HOWE—Presiding)

A symposium devoted to the record establishing 1937 floods in the Ohio Valley was held for the purpose of recounting emergency methods found of value in maintaining or restoring plant operation, rehabilitation procedures, lessons learned in design, and arrangements looking toward protective measures for the future.

At Louisville: Certainly the most epic experiences were those at Louisville, Ky., as related by L. S. Vance, who won his spurs as Chief Engineer of that city's system. The use of a river boat to supply steam to operate a submerged obsolete vertical steam pump has already been related and picturized in earlier issues of WATER WORKS AND SEWERAGE (March, 1937, p. 98; May, 1937, p. 163). After the crest had passed (10 feet above the previous 1884 record flood), an unusual experience in water works operation was the use of a Baptist minister's baptismal boots (arm-pit high) by oilers as soon as the main pump-bearings appeared above water. To operate the poppet valves an air pump was taken from

a steam locomotive. Heroic was the work of torch welders in constructing emergency lines and fittings, in heating welded steam lines (from the boat to the pump) to relieve strains as the river level lowered. Bursting of brick sewers, bringing street collapse and breaking of mains, had been one serious consequence. Remarkable had been the absence of waterborne disease, when considering hazards from back syphonage and main pollution—explained probably by the presence of 0.5 parts or better of free chlorine at all points on the system. From Mr. Vance came high praise of all his organization and cooperation from manufacturers in his darkest hours and the rehabilitation thereafter.

At Cincinnati: After briefly recounting their experiences at Cincinnati, the complete paralyzation of the main pump-station, water rationing, securing of water from outside sources and local wells, Albert S. Hibbs, General Superintendent of Water Works, explained that further levee protection of the present station was impracticable because of building flotation dangers. Therefore, auxiliary vertical centrifugal emergency pump units were to be installed with motors above any possible danger line, and subject to operation by remote control. To minimize standby charges and power costs, such units would be placed on special meters to operate only on off-peak rates except in the emergency. Had 1936 plans of a new 20 m.g.d. station not been postponed the 1937 water emergency would have been averted, in all likelihood.

At Evansville: Experiences reviewed by Louis A. Geupel, City Engineer, revealed that the flood had cost the city water utility only $27,000, as against $4,000,000 estimated total damage in the city. Lessons learned—(1) All sewer outlets from plants should have valves subject to closing under flood conditions. (2) Building design should make easy, prompt and certain the blockage of all doors and windows. (3) The first consideration should be given accessibility and utility, in emergency, of all important valves and plant equipment—appearance and beautification being held a secondary consideration. (4) To call for emergency outside help, standing authority should be asked by all water department heads, without having to secure special authority in the emergency. Amongst lessons learned at Evansville was that corrections requiring an estimated $164,000 are needed; were to be provided.

At Cairo: More concerned with saving the city than the water works had been C. M. Roos, No. 1 Citizen of the community as well as manager of Cairo's company-owned water works. As a result of Cairo's past experiences and preparations, the city was the only Ohio River community in Illinois to escape serious damage. Special preparations by the water utility involved tapping the stand-pipe well above possible flood elevations and equipping standby deep-wells to deliver to the upper floors of important refugee spots and Cairo's hotels. Cairo's "sand-boils" had made unnecessarily sensational news, but were in reality the danger spots. In brief these "boils" were springs brought to the surface by the river head imposed on the normal ground water level—the result being the floating of "quick-sands" from a 25 foot depth to produce "sand-boil" outbreaks. Actually 50 per cent of these fluid sands (95% pure SiO_2) passed 325 mesh sieves. Some of these boils had risen 4 feet above street level; others had made their own craters and ceased to flow. (See picture.) Especial danger came from hidden boils which discharged sand into abandoned wells or pits, most particularly sewers. Therewith, followed cave-in of streets and sidewalks, even to the extent of breaking utility mains, wrecking buildings and smoke stacks. Permanent correction of sand-boils involved cement grouting under 60 lbs. pressure; temporary methods (satisfactory for most boils) consisted of sand-bagging to form an artificial crater-dam; above all, vigilant search and watch for new outbreaks. Mr. Roos made his presentation especially interesting by showing many pictures of sand-boils, active and passive; also, the feverish work on flood-walls and preparations to use Cairo's medieval-like 38 ton steel flood gate which guards Cairo's "postern gateway," and single port of entry for vehicular traffic.

General Aspects: In his customary manner of clear presentation, L. R. Howson, Chicago engineer, summarized the general aspects of what the all-time high Ohio did to water works along its 800 mile rampage from Huntington to the dynamited flood-spillway which saved Cairo. In discussing fundamental considerations, Mr. Howson regretted that the engineer had not outguessed nature because plants built safely above the 1884 flood (100 yr. record maximum) had now been shown needful of a 10 foot factor of safety added to plant freeboard or dyke elevation. The indirect costs from damaged water service having far exceeded direct costs, many cities were planning against another January '37. Sad was the picture for Paducah, Ky., were greater protection could not be justified. Dykes for the Evansville plant were planned at $164,000 cost; Cincinnati was to have its 140 m.g. pure water reservoir storage increased to 500 m.g., with emergency pumping equipment and auxiliary power, costing possibly 5 million; Portsmouth, Ohio, flooded through the sewers, must consider removal of its plant. The Ashland, Ky., plant had escaped because especially designed for flood, with clear-well weighted down by washtank, doors protected by hinged bulkheads, sewer outlets completely valved.

In general, Mr. Howson's conclusions follow:

(1) Raising plants to prevent damage would prove less costly than repairs;
(2) Added storage more costly than emergency preparations, involving duplication of equipment and higher elevations;
(3) Emergency electric system (especially for lighting and valve operation) advocated;
(4) Secure blocking of all pipe openings and adequately valved sewer outlets and intakes.

W. W. DeBerard (Chicago) added a number of pertinent thoughts in connection with "planning vs. prep-

Cairo's Craters

"Doctor" Roos calls them "just Sand-Boils," others say "Quick Sands!" Cairo called them treacherously dangerous until Roos diagnosed and "operated." See "Flood Experiences—at Cairo."

"Corrosioneers"

Charlie Hoover; George Norcom; John Baylis. (Charlie will not be flattered but George and John have no kick.)

aration." A plan or a blue-print, held against the day when the money would become available, were of little use. What happens today can happen again tomorrow, was in sense the thought advanced by DeBerard in his plea that managers and engineers get equipped before the plans are washed away in the next flood. The longer the delay the less the chance of getting what only yesterday proved so needed.

Dr. A. E. Berry (Canada), substituting for E. V. Buchanan, Manager of Utilities, London, Ontario, related experiences of London, Chatham, Stratford, St. Mary's, Ontario, in the April flood of the Thames. The well system of London, for the most part, had been out of commission during a week. An interesting disclosure was made when Dr. Berry recorded the fact that an interconnection between wells had been shown when residual chlorine showed up in a well (being pumped) ½ mile distant from another which was treated with hypochlorite. (The recent experience adds renewed life to a plan, started some years ago, looking to the control of flood and drought conditions on the Thames. The drought of 1936, has revealed the need of higher sewage and waste purification along the Thames or, else, regulated dilution afforded by a reservoir system designed for flood and drought control.—Ed.)

Preparations to Meet Major Catastrophes

(W. V. Weir, Presiding)

At a later point on the program was held a joint "Round Table," by superintendents and chemists, which was for the purpose of recording methods employed by water utilities, and plans and preparation to meet major catastrophes.

N. A. Eckart (San Francisco), in a paper presented by Jeptha Wade, Chief Engineer, California Water Service Company, stressed the necessity for the establishment of personnel authority and responsibility in case of major catastrophes (in California, earthquake damage); an adequate alarm system and knowledge of actions to be taken in sequence by key-men. On the San Francisco system there were 4 main districts with a key-man and runner assigned each. A portable or mobile chlorinator had proved a highly important piece of equipment, and a great deal depended upon purification men using judgment and having advanced knowledge of what to do. Prearrangements had been made with manufacturers for quick use of equipment, considered vital in operation and repairs. [Mr. Eckart's paper contained much in the way of suggestive discussion, which justifies study of the full paper when it appears in the Journal.—Ed.]

H. E. Halpin, Engineer, Factory Mutual Insurance Company, Boston, Mass., in discussing preparation for major fires and conflagrations said that of high importance was the interchange of service by fire departments in neighboring communities. This required plans in advance and standardization of hose connections. Of high importance was the checking of hydrant capacities (adequacy of mains) and suitable markings of hydrants. Adequate and readily available records of the system and valve locations, and value of cooperation with the fire department, needed no stressing. A water-utility truck and proper crew should be in readiness to answer all second alarms. Radio broadcast to cut domestic consumption temporarily had proved to raise hydrant pressure by 10 pounds in a major fire in Chicago. Of highest importance was the growing use of elevated tanks effectively located.

In discussion, the value of radio communication in emergency operation, as well as for broadcasting, was emphasized by several members. Broadcasting, however, should be confined to local range; and, two way communication, for accuracy, had been proved essential in Louisville's recent experiences wherein faulty interpretation of code had brought useless materials and serious delays.

Water Hammer—Pipes

In a rather technical and involved presentation, S. Logan Kerr, of United Engineers and Constructors, Inc., Philadelphia (Chairman of A. S. M. E. Committee on Water Hammer) told what recent studies of the water-hammer phenomena had revealed. Presenting the theory of water-hammer, by graphs he showed how it was possible by superimposition and argumentation of the hammer waves to actually accumulate 3 times the force theoretically computed on the value of $H = \frac{av}{g}$.

Praising the classical work of Jakowski, he pointed out that no single formula, yet advanced, would apply under all service conditions. The dangers in using the simplified approximate formulae, he illustrated by blackboard examples. The rapidity of hammer wave travel was revealed by a case in which 40,000 ft. of line had been traversed in 22 seconds. Mr. Kerr, in touching on the practical side, cited the simple closing of a fire hydrant, in which the time of closing would make little difference in comparison with the *rate* of closing at the *very end*. There was the danger spot, as was true of any valve closure, and particularly the old style flap-type check valve.

Alfred Theard, Genl. Supt. New Orlean's Service & Water Board. (In his pocket he took home the 1938 convention.)

Cecil Lea, Chemical Engr., Imperial Chemical Industries, Ltd. (A guest from Liverpool, England, here studying American methods.)

Here and There at the Convention

(1) "Pete" Peterson, Neptune Meter's Atlanta Mgr.; (2) Clark Keith, Mgr. Utilities, Windsor, Ont.; (3) Lloyd Nelson, U. S. Pipe's Pittsburgh Mgr.; (4) A. P. Kuranz, Supt. Water, Waukesha, Wis.; (5) W. R. La Due, Water Engr. and Supt., Akron, Ohio; (6) "Pat" Kelly, Leadite's Boston Mgr.; (7) Jim Kennon, Engr.-Mgr., Pittsburgh's Water Dept.; (8) Seever Jones, Vice-Pres., T. A. Gillespie Co., New York

"Determining Wall Thickness of Underground Steel Pipes," by RUSSELL BARNARD, Engineer, American Rolling Mill Company, Middletown, Ohio.

Mr. Barnard touched only the high spots of his voluminous paper, dealing with the selection of proper wall thickness in the case of protected and unprotected steel pipes. Strange to many was the statement that interior corrosion was not a point of major consideration, because the protective iron rush set up made rare the pitting through of steel pipe from the interior. Soil corrosion was the really important consideration. A review of findings in the extensive 12 year study of soil corrosion of pipes, made by the U. S. Bureau of Standards, preceded a presentation of empirical formula and equations for determination of wall thickness of pipes of bare steel, where soil conditions were known. Such determinations were illustrated by curves showing pit depths and pipe life under various soil conditions and the wall thickness required. From such, it was apparent that soil surveys were highly valuable in spotting corrosive areas. Design economy could only result in specifying needed wall thickness or protective coatings in areas where essential, and reducing such requirements where waste would otherwise result if using heavy pipe or coatings where not justified. In the case of coatings, Mr. Barnard stressed the false economy of thin or unproven materials for coatings, because density and thickness were essential where protection was really needed. As an illustration of the economy of preliminary soil surveys, and specifications based thereon, he presented study curves on three classes of soils. Applying the equation, Class 1 soil (sandy and mild) demanded only a 3/16 in. uncoated wall; Class 2 (medium) demanded 5/16 in. uncoated; Class 3 (wet and corrosive) demanded coated pipe, thus allowing 3/16 to ¼ in. wall thickness to be used as the overall most economical pipe for the condition at hand.

"Why Cast Iron Pipe of 2 Inch Diameter?" was the question propounded and answered in a brief, word-conserving paper by J. D. SAMPLE, Executive Vice-President, McWane C.I. Pipe Co., Birmingham, Ala. The original 2 in. C.I. pipes, first served for extending domestic service into fringe areas surrounding the corporate limits of cities and towns, had since come to be favored as a service line pipe. Again, for connecting the larger mains on the long streets through short streets (grid-ironing) with the smaller pipe, thus obtaining flow from both ends of the block. These pipes had grown in popularity for use around plants, for filter underdrainage, industrial use, country estates, golf courses, to result in a nice tonnage. An improvement in manufacture, involving perfected mechanical casting, had resulted in longer lengths with higher resiliency and toughness, more uniform wall thickness. Joints were now available in the older lead precaulked style or the newer screw joint, or a combination for easier, more economical and faster laying.

"Transite Pipe" was presented through use of a sound movie, just completed by Johns-Manville Company to picture the manufacture, testing, shipment, handling and laying of asbestos-cement "Transite" pipes.

Cross Connections in Air Conditioning

An amplified cross connection problem, as the outgrowth of air-conditioning installations, was weighed by PROFESSOR F. M. DAWSON, Dean of Engineering, University of Iowa, and a pioneer in detection and correction of plumbing cross connection hazards within buildings. Professor Dawson pointed out the back syphonage hazard created when piping cooling water through from the supply line in a closed system to the sewer. Such had been found to be the condition in 18 of our 25 installations investigated. Aside from danger of pollution suck back, there was the question of oil or refrigerant leakage back into the water system. In some cases the domestic use supply into buildings was being used en route for cooling—another questionable practice. Professor Dawson roundly condemned air conditioning engineers who had suggested that the city water, after serving for cooling, could be returned through pumps to the city mains unimpaired. To adequately safeguard the city water nothing less than a holding tank, fed over the top by city water, would be a positive protection. This case was one parallel to industrial cross connection cases. The very least that should be required was a 4 in. gap between the end of the condenser discharge pipe and the sewer. With it all, routine inspections should be maintained under the health department or the water utility.

Directors

"Bob" Weston—New England Section—Boston
John Quinn—Kentucky-Tennessee Section—Knoxville
John Winder—Southwest Section—Dallas
(Only hotel facilities kept the 1938 convention from going to John Winder's home town.)

Consulting Engineers

From Atlanta—H. F. Wiedeman
From New York—C. L. Bogert
From Kansas City—N. T. Veatch, Jr.

Water Purification Topics

Corrosion Control

Always important, **"Corrosion Control"** was dealt with in a symposium led by CHAS. P. HOOVER, Superintendent of Purification Works, Columbus, Ohio.

Mr. Hoover reviewed the Columbus findings coming from a practical study of the effect of waters treated to various degrees, such as normally followed in modern corrosion control by lime application for pH adjustment. Particular emphasis was placed on the effect of such waters on 5 hot-water household boilers and piping. The boilers kept in service for the period of one year were sawed in two lengthwise and examined photomicroscopically and otherwise. It was evident, though surprising, that the greatest pitting resulted from the Columbus softened waters adjusted to pH 9 and pH 9.3. Simultaneously the water was scale depositing. On the other hand the same softened water, when recarbonated to produce pH 7.5 (7 ppm. CO_2 and total alk. of 42), showed practically no tubercles or pitting and the least deposition of lime carbonate film. The water raised to pH 10 produced no rust pits or tuberculation but dissolved zinc rapidly and deposited too much carbonate coating. From such observations, it had to be concluded that galvanized boilers and piping would be less damaged by Columbus water containing bi-carbonates and free CO_2 present (pH 7.5) than with normal carbonates (pH 9.0 and above), the explanation being the destruction of the zinc coating and attack of the steel plate. (For details the reader is referred to Mr. Hoover's illustrated article in the October, 1936 issue of WATER WORKS & SEWERAGE.—ED.)

In actual practice at Columbus, Mr. Hoover said that it had been decided to recarbonate the finished water to produce normal carbonate alkalinity of 9 parts or somewhat lower. If cold water corrosion appeared, the alkalinity would be raised somewhat but not the pH value. Study No. 2, now under way, involved running hot and cold water, for a year, through black iron and galvanized pipes. The pH range was 7.0 to 9.3, in five steps, for the purpose of determining what was to prove most satisfactory under actual hot and cold conditions. Study No. 3 was being made to determine the effect of the various pH adjustments (hot and cold) on brass, red-brass, copper, Armco and Newport steels and a zinc-alloy coated steel. Study No. 4 was to compare galvanized as against ungalvanized steel hot water tanks. Study No. 5, the effect of mechanical deaeration in parallel with No. 4.

JOHN R. BAYLIS (Chicago) pointed to fact that the Columbus studies showed that there was a pH range at which a protective coating would appear without zinc attack by the hot water. Below pH 7, according to the solubility curve for zinc, galvanizing would be taken off. Conducted on a more practical basis than laboratory observations, Hoover's demonstrations had greater value and indicated that much could be learned out on the system by observations in selected homes. It was Baylis' opinion that there was an overall economy to consider; and, that the water utility should treat to protect against cold water corrosion and let the consumer individually take care of hot water troubles by installing piping and boilers of more resistant materials.

GEORGE D. NORCOM, Federal Water Service, New York City, reviewed the general considerations in corrosion control and the need for considering effects on house-plumbing as well as services and mains. With treatment to adjust pH value, red-water control had been fairly well proven but how far such treatment had checked tuberculation there was some question, proof being lacking. To check into this matter studies were under way by himself and Thomas Wiggin on cleaned mains receiving water adjusted to be non-aggressive to calcium carbonate, and others with higher and lower pH values maintained. Experience with 125 supplies, 32 being lime treated for corrosion prevention (by use of the calcium carbonate solubility test) it had been found that the required pH varied between 7.9 and 9.2 and the effective value was dependent largely on the mineral and, possibly, the organic content (buffer value) of the water. Thus the required treatment would vary with river stages or variation in reservoir conditions—the lower the mineral content the higher the dosage of lime required. On a rather soft water a dosage of 30 p.p.m. lime to produce pH 8.8 had been required, the lime serving to build up a mineral content along with the pH value.

CHAS. R. COX (N. Y. Dept. of Health) recounted interesting observations indicative of the fallacy of aeration to reduce corrosion of a very soft supply. Two well supplies, closely located on Long Island, had essentially the same composition. One received aeration, the other none. Water analysis showed the unbelievably low alkalinity of 1 part; total hardness 24; pH 5.1 and

From Canada, Utah, Illinois, Texas, Ohio, Georgia

Came the Sandersons (Toronto), and Ted Rust (Provo, Utah); "Cap" and Mrs. De Laporte (Toronto); Wesley Polk, Evanston's New Director of Public Works, and (With Apologies) Mrs. Polk; A. P. Jones (Houston) and Jim Brown (Columbus); from Atlanta "Bill" Rapp, His Namesake Wm. Rapp Weir, and William's Daddy, Paul Weir

5.2; carbon dioxide 21; iron 0.3 and 0.5. The supply aerated showed a lowering of carbon dioxide to 5 parts and pH increase to 6.6. In the system the iron pick-ups (corrosion) raised the iron from 0.3 to 0.7 parts. The iron in the non-aerated water seemed to be depositing in the system since the 0.5 parts dropped to 0.03 parts. Further studies of these supplies were being conducted, but conclusions to date indicated aeration more harmful than beneficial and pointed to the value of pH adjustment as more efficacious.

ROBERT SPURR WESTON, Boston Consulting Engineer, a pioneer in water treatment with a wealth of experience, pointed out that adding lime to materially boost the hardness of soft Eastern waters was a conflict with public opinion. For cold water complaints he had found that bringing up the pH to 7.8 with lime provided marked improvement without unduly raising the hardness. He referred to the adaptation of contact beds of limestone or the more soluble magnesium carbonate, in pressure or gravity units for smaller supplies, to lower the free carbon dioxide and boost pH and hardness. More expensive, but more rapid, than limestone was reported to be a German product known as "Magna-Masse," a combination of roasted dolomite with composition approximating $CaCO_3$: Mg O.

I. M. GLACE, Consulting Engineer of Harrisburg, Pa., was asked by the chairman to report his experiences in lime treating of a very soft Pennsylvania mountain supply. Mr. Glace explained that in trying to produce the much talked of egg-shell coating on the pipe walls, lime had been used—only to make trouble and increase consumer complaints of red-water. The question he raised was—"Does the lime treatment in some cases coat-over the existing tubercles and in others soften up and release the rust like deposits in dead ends and service lines?" Concerning the last, his experiences had indicated the latter reaction to be a fact and the cause of troubles in instances where lime was given up as "a cure worse than the ailment." Beginning over again the lime treatment had been started in moderation and gradually boosted, during which period main flushing at remote points had been systematically and constantly employed. Observing steel service lines at the plant, those practically closed with rust scale had been almost completely cleared since the second program of lime treatment began. Now, observation seemed to show that some coating of the inner walls was under way. (For details, see Mr. Glace's story on *"Tuberculation in Reverse,"* which is to be found in our June, 1937 issue.—ED.)

With Regrets

We find it necessary to hold the balance of this report covering other papers and discussion before the Water Purification Division, as recorded by Associate Editor, Harry Faber, for our next issue.

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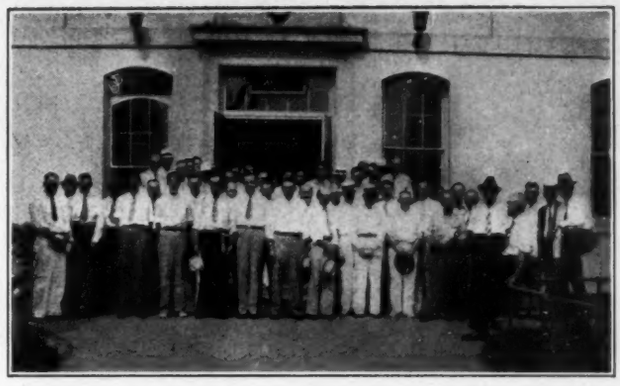
South Carolina's Fifth Water Operators School

The accompanying picture has been sent us by B. P. Rice, South Carolina's live-wire State Sanitary Engineer, who takes just pride in the results from South Carolina's short-schools, and progress being made in operator certification as a voluntary licensing program. The two day short-school is to be held annually under the direction of a committee selected from the revived South Carolina Water Operators Association, and sponsorship of the State Health Department.

The South Carolina plan in promoting and encouraging operator licensing through the voluntary system, as a beginning, is worthy of study by those states considering a licensing program. Lack of space precludes reproducing the plan and its requirements here, but a copy can be had by addressing B. P. Rice, State Department of Health, Columbia, S. C.



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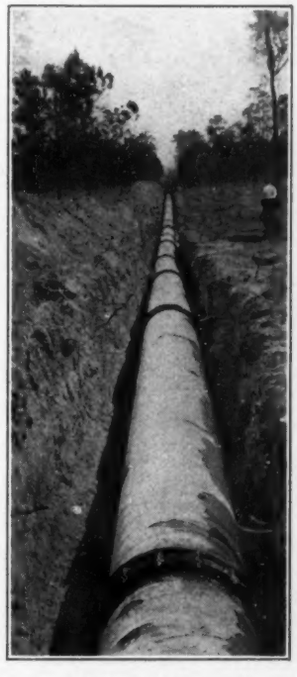
A "Krafty" Water Line, May We Say?



The accompanying picture shows an easy-going stretch of a 9.5 mile supply main constructed, in goodly part, through heavy timbered country and three miles of tough cypress swamp. It brings water from Black River to the Georgetown, S. C., pulp and paper mill of the Southern Kraft Corporation.

This main, constructed of 24 in. bitumastic lined and coated Armco spiral-weld steel pipe, has a capacity of 8 million gallons per day. Because of severe soil conditions, for the better part of the run, the pipe was spiral-wrapped with felt. Utilizing pipes fabricated in 49 ft. lengths, joints were reduced to 106 per mile. For jointing, Dresser flexible couplings were selected, largely because of the difficult terrain crossed, and resultant construction economy.

A unique feature in the crossing of the swamp was the towing into position of floating (end-blocked) pipe lengths, through the water-filled trench, and there carefully sinking them to trench bottom and coupling—a procedure which the flexible bolted-couplings made possible. Along the stretch, here pictured, a record, of 2,800 ft. of line (57 joints) laid and coupled in one day, was made. The job was completed in 70 days with a crew of 11 men, composed of a foreman and seven laborers, two men for bolting up the couplings and one for coating them with hot poured bitumastic. The pipe was fabricated and lined, coated and felt wrapped, in the Armco pipe mill at Middletown, Ohio.

SEWER FLUSHING

The Extent to Which It Is Effective

By JOHN D. WATSON
Consulting Engineer, Ruislip, England

This is the initial contribution from an authority who hardly requires an introduction. As a visitor to America in past years and an admired friend of our late George W. Fuller, Mr. Watson is personally known to many of our American readers.

In England he has long been recognized for his achievements as a consultant and designer of water works and sewerage projects of repute. His latest achievement is the design of the gigantic 690 M.G.D. Mogden Sewage Treatment Works serving 16 communities in the environs of London.

This article reveals much pertinent to "Sewer Flushing" practices and presents what may be considered satisfactory flushing and what will prove a waste of effort and funds. The all important depth of flow in flushing, as compared to velocity flow without the needed depth, is pointedly emphasized. If we interpret correctly, many readers will find it necessary to consider some of our existing pseudo-flushing practices as little more than sewer "rinsing," after reading the depth—velocity discussion by Mr. Watson—an authority with a wealth of experience and years of observation to draw upon.

Readers of this initial contribution will be happy to learn that it is one of a series to appear under Mr. Watson's name.—Ed.

THE basic condition upon which calculations for sewer flow should be made is that the sewer have a self-cleaning velocity. In other words, it should never tend to silt up even though the dry weather flow condition persists for long periods while at the same time it must be capable of taking storm water, unless it is wholly diverted from it. Provided they are properly constructed it is not usually difficult to give sewers a sufficient fall for this condition to be fulfilled. Main sewers will work with little or no trouble when laid on a grade of 1:1000 or less and, when the London Main Drainage was designed some 70 years ago, experiments showed that a velocity of 1½ miles per hour was sufficient, and very little cleaning is necessary in these sewers today. They vary from the familiar oval section of 4-ft. x 2-ft. and 8-in. to circular sewers of 12-ft. diameter. They are mainly built of brick.

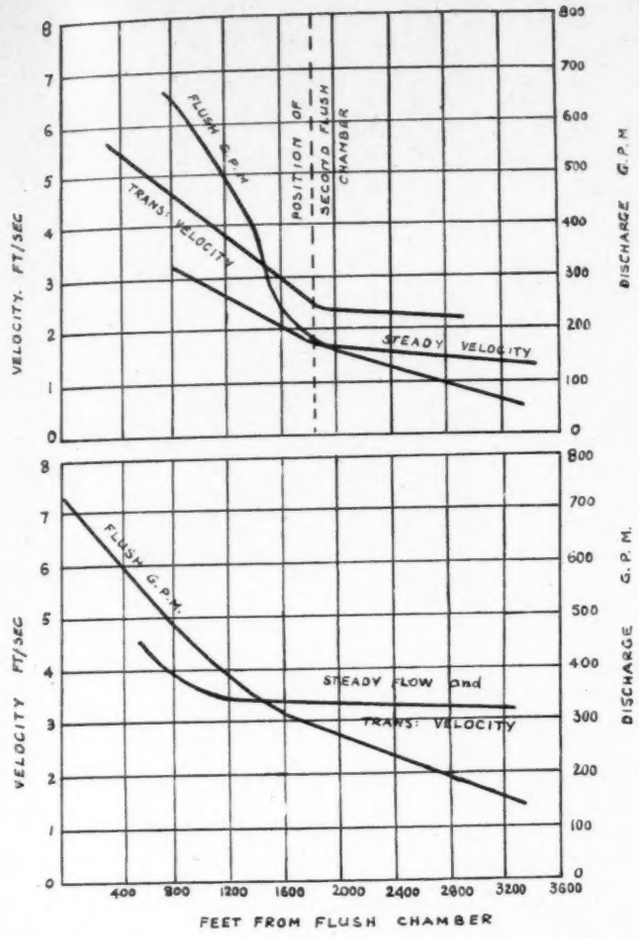
Trouble is rather more likely to occur in the smaller branch sewers which have to be put in of a size to allow of increasing population so that for perhaps 10 or 20 years, normal flows are insufficient to maintain a self-cleansing velocity; and, while it is usually possible to divert surface water into them, it usually has to be kept out in order to save pumping and purification costs. The system adopted at one time at Hamburg, of constantly flushing the main sewers from a small river, enabled them to be laid at 1:3000, and to be run practically half full continuously, but that principle has rarely been adopted. The usual practice, when artificial flushing is resorted to, being either to provide gates to dam back the flow and then to release the pent up sewage for the purpose; or the use of tanks operated by an automatic syphon, the latter arrangement being as a rule the better one.

The Great Importance of Depth in Flushing

When arranging for it the important points to bear in mind are, that the flush is not going to be effective over any great distance, and that it is the depth of flow over the invert of a sewer which is the most effective in moving the material which is the main cause of obstruction. That of course, is the condition intended to be provided by the oval sewer, silt being usually the main cause of the trouble in the present connection. In the form of road detritus, though it may reach the sewers mainly in times of storm when there should be sufficient velocity to carry it to the outfall, road detritus in the average condition has been found by experiment to require a velocity of nearly 1-ft./sec. to keep it on the move and if small pieces of broken stone and similar material get into the sewer (which by some unaccountable means they do) such, according to size, will require a velocity or 2½ to 3½-ft./sec. to move them. Incidentally, it is such obstructions in the first instance, as a rule, which cause a general obstruction to build up.

Such material always moves along with a speed of travel less than that of the stream (usually not more than half) and though 2½-ft./sec. flow velocity may move a piece of stone it will only barely do so in 1-in. depth of water. But, if the depth be increased to 6-in. it will roll along quite easily at 2-ft./sec., confirming the contention already made that it is the depth of liquid in the sewer that is the really important factor in keeping it clean. Therefore, the conclusion to be reached, is that, in circular sewers at all events and more particularly in the average branch up to 30-in. dia., the basic cause of silting is *insufficient depth* of flow *rather than velocity;* and, especially is this evident in lateral sewers which only receive intermittent discharges from the dwellings connected to them. Thus, deposits commence which ought to be periodically flushed away because if they are not removed, although they might not immediately render the sewer inactive, they cause a filmy growth (slime) to appear on the pipe wall. This growth in turn further reduces the velocity, and so matters go from bad to worse with the additional evil of the sewage becoming septic and producing large volumes of sewer gas, with its well known attendant evils.

This can be demonstrated in a simple manner by purposely putting some coarse sand or fine gravel in a sewer. Then it will be found that while motion is set up by dragging action, the particles are more or less lifted up into the stream and further motion is carried on by the added effect of suspension. The greater volume of material is naturally carried in the lower layers of the stream, the total quantity being proportional to the depth. Motion, too, will be seen to be from the sides of the sewer towards the centre, the major portion of the suspended matter being carried along the centre of the stream. The amount and the size of the material being carried in suspension depends upon the velocity of the stream and its depth of flow. But, to a much greater



Curves Revealing Relationships Between Depth of Sewer Flush (Rate of Flush Discharge) and Effects Down-Sewer

extent depth is controlling, because in appreciable depth of liquid the particles are thrown to a greater height; and, as the velocity of descent of the particles is the same in both cases, the deep stream carries the particles further owing to the greater opportunity of remaining suspended.

Effects of Flushing

The conclusions to be reached, therefore, are that as a general rule it is advisable to provide means for flushing pipe sewers when they are laid at flatter gradients than those listed below:

12-in.....1:300	21-in.....1:600
15-in.....1:400	24-in.....1:700
18-in.....1:500	27-in.....1:800
30-in.....1:900	

Between 2,000 and 3,000 gallons at a flush, according to the size of the sewer and provided it is released once or twice every 24 hours, usually suffices. In any event it should be an amount that, when it does come into the sewer, practically fills it at that point. This, because the depth of the flushing wave near its point of origin decreases as it moves downstream to a point at which the depth and velocity are but little affected by the discharge. As an example, one can consider a 12-in. sewer flush by a 1,500-gallon tank through a 10-in. syphon in 1¼ minutes.

On the accompanying chart the upper set of curves relate to such a sewer laid at 1:630. One curve reveals transmission velocity, the other steady-flow velocity. As regards the former, the rate of transmission, at the commencement of the flush and at different distances from the flushing chamber, is that which would give the maximum scouring velocity, assuming the flush to be discharged into an empty sewer. This velocity lasts but a few seconds and its effect reaches but a short distance. In the matter of the steady-flow velocity, during the period when the maximum volume of flushing water is passing at different distances from the flushing chamber, it will be observed that this velocity lasted for a minimum period of 1 min., the period increasing with the distance from the flushing chamber. There is also a third curve which reveals the maximum volume of flushing water in gallons per minute at different distances from the flush chamber. From this curve, the effect of varying the amount of flush water discharged per minute can be determined. The lower set of two curves, in comparison, relates to a 9-in. sewer having a flush of 750 gallons for one minute.

Facts and Conclusions

The principal facts which become apparent from an examination of these curves are that:

(1)—The velocity dies off rapidly at first until it attains a certain value after which the diminution is small. As a result the flush is transmitted over an appreciable distance, probably about one mile.

(2)—With flat gradients, the velocity when the maximum volume of flush water is passing is less than the rate of transmission at the commencement of the flush, the difference gradually decreasing as the gradient decreases until the velocities are identical—such being indicated by the lower graph.

One can conclude, therefore, that the slope of the advancing flush will gradually flatten as the distance from the flushing chamber increases except where the gradient is sufficient to secure a high velocity. It is noticeable, also, how the steady flow velocity is over 3-ft./sec. at a distance of more than 3,400 ft. from the flush chamber. If, therefore, the sewer gradient is reasonably good, though appreciably less than that above set out, a good flush (rapidly discharged) will keep a sewer clean for at least half a mile even though its capacity be considerably in excess of normal dry weather flow requirements. And that, as already indicated, is the main purpose of artificial flushing.

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WPA to Survey Water Works And Sewerage Facilities

The W.P.A. has started to gather together comprehensive information relating to municipal water works and sewer departments in 158 principal American cities.

Data will be gathered on organization, methods employed, equipment, personnel, costs, administration and other phases of water and sewer systems in all cities of 50,000 population and upwards.

Sponsoring this move to collect, assemble and distribute such information, as a permanent record for reference and comparisons, is the U. S. Conference of Mayors of which Mayor LaGuardia of New York is president.

Data gathered by field men from water and sewage authorities in the various cities will be forwarded to Washington where the facts will be analyzed and assembled for publication. What the plan for distribution is has not been announced unless it be through the Conference of Mayors.

CUTTING CAST-IRON PIPES

The Atlanta Method Proves Practical, Economical, Dependable

By W. M. RAPP
Superintendent,
Construction and Distribution,
Atlanta, Georgia

"As Clean as a Hound's Tooth"
Note Regularity of Fracture and Absence of Chipping or Projections

Some time ago a unique and effective method of cutting cast-iron pipes was demonstrated before a group of engineers and water works men in Atlanta by the inventor of the method—W. M. Rapp. Such was briefly recounted and pictured in WATER WORKS & SEWERAGE *for April* 1932. *At the recent convention of A. W. W. A. Mr. Rapp reported the procedure had proven decidedly economical and in all respects practical and dependable.*

Asked to present the details of the Rapp-Atlanta Method for the benefit of our readers, Mr. Rapp has supplied a copy of an illustrated report covering the method. Prepared by J. N. Eley, consulting engineer of Atlanta, it presents the exact procedure, time consumed in each operation and a complete set of pictures of sequence operations.

In this article is presented pertinent parts of the report and selected pictures, in the form of a contribution of the modest inventor of the method. Due acknowledgment is made to Mr. Eley for his excellent and concise report and the clear photographs, a few being here reproduced.—ED.

IN BRIEF, the method of pipe cutting, to be described, consists of drilling a circle of holes around the pipe and placing tapered wedge pins in each. Then, driving these up in sequence until the split once started, from hole to hole, travels the circumference of the pipe rapidly. The result is a "ripped" line of neat breaks from hole center to hole center.

The following has been drawn from a report by J. N. Eley, consulting engineer, which is a first-hand account of one pipe-cutting job done for Buford, Hall & Smith, Atlanta contractors, in connection with the construction of one of Atlanta's new sewage treatment plants.

W. M. Rapp (Honorary Member A. W. W. A.)

The pipe cut was a standard length of 54 inch Class B. Cast-Iron pipe produced by U. S. Pipe & Foundry Co.

For the job, the contractors used their truck mounted Worthington air-compressor unit, having a capacity of 105 cfm. at 100 lbs. pressure. The balance of the needed equipment was loaned by the Atlanta Water Department, and consisted of the following:

An Ingersoll-Rand, Size B, Non-Reversible Air Drill, mounted in a frame with hand feed, chains and toggle-level locking device, designed by Mr. Rapp. (See picture.)

An adjustable pipe scriber; two track-levers, used in pinch-moving freight cars, for turning the large pipe; the required number of round tapered pin wedges, having opposite faces slightly flat for reasons later obvious; two sledge hammers.

(Note—The same equipment used for cutting the 54 inch pipe is also used on all pipes between 12 and 60 inch diameters.)

The crew making the cut consisted of: One compressor operator, one handy man, three colored laborers. One of the latter was a veteran employee of the Water Department, but none of the remainder of the crew had ever seen the method used before.

The Procedure

Because of the boggy nature of the ground, the length of 54 inch pipe was first rolled onto 8 x 8 pine skids. This facilitated turning it with the freight car moving-levers through various degrees, to make scribing, drilling and wedge driving easier. With the adjustable scribe a drill guide line was scribed around the exterior circumference and centers, for the 1 inch holes to be drilled, were marked with a center punch.

Drilling

The air operated drilling machine was then set up on the pipe and connected to the compressor air lines. The

The Drilling Under Way
(Just a minute, boys; time out for this snapshot of the crew)

drilling then proceeded around the scribed line. For convenience and neater and faster work, by unexperienced workmen, the pipe was turned about 33 degrees, at intervals, to keep the drill in a more nearly vertical position.

Wedge Driving

The drilling completed, pin-wedges were tightly set in 33 of the 45 holes by hand hammer. The flat edges faced with the line. Then began the sledging, or the driving-up operation. Starting with pin No. 1, full force blows were struck each odd number pin in sequence—3, 5, 7 . . . 33. From pin 33 the driving-up was reversed with the sledging of the even number pins, 32, 30, 28 . . . 2, in sequence. After two minutes (less 5 seconds) of this procedure a fracture, approximately 12 inches long, showed up from pin 5 to pin 8. After 45 seconds more of sledging the fracture had extended half-way around the pipe. The pipe was then pinch-rolled forward and pins were inserted in the 12 remaining holes, thus brought into position. Sledging of alternate pins was resumed in sequence, as before, and after another minute (plus 3 seconds) the end bell dropped down and the job was complete.

How successful the operation was, is shown in the accompanying pictures revealing the clean and regular fracture straight through the 1.9/16 in. pipe walls, and departing but little from either side of the scribed line. No horizontal fractures, radial to the holes, appeared. The absence of chipping and projections is likewise worthy of note.

Time Consumed:

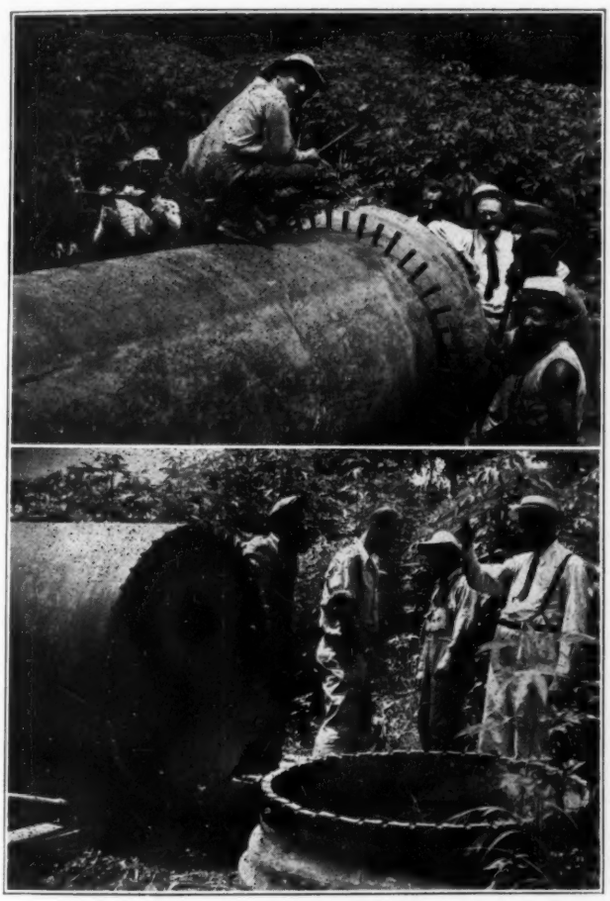
A careful stop-watch record was kept of the time consumed in the several operations. A recapitulation follows:

Operation	Min.	Sec.
Scribing (drill line)	3	55
Rolling pipe (total)	6	14
Center punching (on line)	10	42
Setting Machine (on line)	5	57
Drilling (45—1 in. holes)	35	56
Backing and resetting drill	26	53
Removing machine (from pipe)	0	41
Setting Tapered Wedges (45)	2	10
Driving-up wedges	3	48
Throwing the bell	0	15

Total consumed time—1 hour, 36 min., 31 sec.

Costs:

Compressor operator ($1.00 hour)	$1.61
Handy man (75 cents hour)	1.21
Two laborers (40 cents hour)	1 29
One laborer (52 cents hour)	.84
Total labor cost	$4.95
2.41 gals. gasoline at 22 cents gallon	0.53
Total cost of cutting 54-in. Class B pipe	$5.48



Before and After "Taking It"
Drilling completed and pin-wedges set ready for the boys to let loose with the "persuaders." After 3 minutes and 48 seconds of this staccato, here's the result below. See also picture in the heading.

"Bill" Powledge and Air Drill
Both loaned for the pipe cutting job
(Now 60 years old, this faithful colored man has for 35 years continuously served Atlanta's water works. It is his kind that the South feels the deep loss of with their going.)

A Commendation:

In a letter of commendation, Roland B. Hall, president of the contracting firm, Buford, Hall & Smith, who have used various other methods of cutting pipe (but never before this method), states that the Atlanta method appealed to them as being the most dependable, as well as the most economical, method of cutting large pipes that had ever been utilized by them. It seemed especially advantageous in the cutting of centrifugally cast pipes. In the future they intend using our Atlanta Method "because of its simplicity and the adaptability of one set of equipment and a common procedure for pipe of all sizes—12 inch and upwards."

We are very pleased to know that others find our efforts here in Atlanta worthy ones, and we will be repaid in knowing that we have contributed something of benefit to the water works profession at large.

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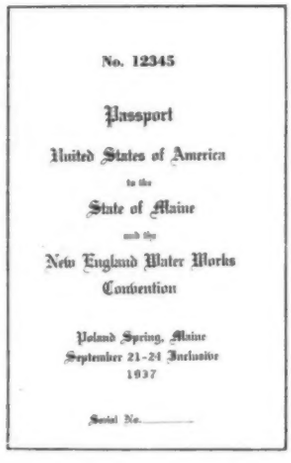
N.E.W.W.A. 1937 Convention To Be Different

"Down to Maine" It Goes to Honor President Harry Fuller

(Dates Sept. 21-24)

Much is being heard of the departure from tradition and custom by the New Englanders, in their decision to break away from the "big town" convention of past years and go to the woods instead. But what a "woods" New England Water Works Association's Convention Committee picked, when it chose Poland Spring House at celebrated Poland Spring, Me., as the convention place of 1937. And, right smack in the prettiest season of the year in those parts.



No. 12345

Passport

United States of America

to the

State of Maine

and the

New England Water Works Convention

Poland Spring, Maine
September 21-24 Inclusive
1937

Serial No.

What an opportunity is presented to spend a most profitable and enjoyable four days at one of America's best known beauty spots and resort places—and, too, at post-season convention rates. Lakes, mountains, pine-groves, the reputed Poland Spring, front door golfing, boating, tennis, riding, hiking—all lend an attraction to the conventioneer who is fed up on big city conventions, with too much smoke, not enough fresh air, much noise, 20-mile drives to golf-courses, excursion trips in smelly harbors or rivers.

Yes, the Poland Spring Convention will be different! In keeping with the rural setting, N.E.W.W.A.'s Entertainment Committee promises a barn-dance, with all the fixin's; an old fashioned square dance ("Swing your corner and back ag'in!")—with real Maine fiddlers doing their stuff. There will be a special trip to the interesting and old settlement of "Shakers" (a religious sect) on nearby Sabbathday Lake; another to Paris Hill and other points. There will be horse-shoe pitching, Sunday evenin' singin' (only it will be on Monday evenin'), etc., etc. Leave it to David E. Moulton, "Bill" Orchard, Mrs. Horace J. Cook (Ladies Committee Chairman) and John Wickwire to see that the entertainment is novel, interesting, ample.

Oh! yes, we almost forgot that prospective Poland Spring conventioneers will want to know something about the work-side as well as the play-side of the 1937 meeting. The technical program (arranged by Karl R. Kennison, Chairman, E. S. Chase, Roger Esty, Warren Scott and Gordon Fair) is typical of the usual quality of N.E.W.W.A. programs, which produce high calibre papers for its Journal, ample and lively discussion of every-day and unusual operating and maintenance problems. This year two major symposiums have been planned—one on "Corrosion"; the other on "Gravel-Packed Wells." There will be two Superintendent's Sessions and a Chemists' Round Table; the latter having been first introduced at the winter meetings, with great success. (The completed program had not been issued at the time of the preparation of this announcement.—Ed.)

Rates at the Poland Spring House and Mansion House are on the American Plan. These start at $6.00 per day for room and meals—which are comparable to the cost of equivalent accommodations in first class metropolitan hotels.

It's a great chance for vacation and convention wrapped into one package. It's a great opportunity any way one takes it.—So, let's all go "Down to Maine" to be on hand for President Harry Fuller's show, September 21-24, at Poland Spring.

(*Important*—Considering what happened in the last election, it is said that all "foreigners" (Democrats and "New Dealers") will need passports to get into Maine. So, N.E.W.W.A. is preparing for such an eventuality by issuing, to all convention "prospects and suspects," the "passport" here pictured. For those who fail to get one in advance, a supply is being taken to the convention in order to insure free-travel through Maine to all conventioneers.)

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Bathrooms with Two Kinds of Water

(Patent Pending)

Here is what Paul Weir, Atlanta's "red-top" Superintendent of Filtration, thinks up in between his new pipe corrosion studies, and experimentation with Georgia's "Monterillinitic" (Slocum) clays.

The following was clipped from the May issue of "Drippings from the Georgia Faucet," which is the official news bulletin issued "Now and Then" by the Georgia Water Works and Sewerage Operators Association. It is put together by "B. Coli," Editor in Chief, who is none other, we have reason to suspect, than Paul Weir himself. At any rate, here is a real "Yankee" idea from "Joygã" and we lay it to Paul. Aside from this "splash" some very worth while "Drippings" come from Georgia's worthy "Faucet." The only cost of this publication, to association members, is "Gallons of Enthusiasm and Pounds of Ideas."

Suggests "The Faucet":

"The year round temperature of the water at Warm Springs, Ga., is 90 degrees. Just a mile away is Cold Spring, with a year round temperature of about 60 degrees. Looks like a good chance for a real-estate operator to make a 'clean-up.' Build houses half way between; run two half-mile pipe lines; offer to home buyers 'Absolutely Free! Two Kinds of Water'—hot and cold."

Copyright, 1937 (A. R.)*
*After Roosevelt.

MY IMPRESSIONS OF SEWAGE DISPOSAL IN AMERICA

By DR. HERMANN BACH*
Consulting Chemical Engineer, Berlin

The Author

BEING engaged during the spring on a wastes disposal problem of a large and gloriously known American chemical company, I had the opportunity to inspect a number of American sewage treatment plants in operation, also experimental plants working on certain special problems; and, to see several new plants under construction and some designs for future schemes. I discussed sewage and wastes disposal topics with prominent experts of American sewage practice. On request of the editor of this journal—being for many years an attentive reader of its contents with much profit to my professional knowledge—I will now try to put down some of my impressions of sewage disposal as practiced in America.

It is difficult for a professional man, visiting a foreign country, to avoid comparisons with the practice and trends in his own country where he has worked for a lifetime. Yet, it is a supposition to a fair understanding of the trends and the developments of any foreign public work, to visualize this work from the angle of the original needs, customs and mental movements of the country in question. It is because the technique of any kind does not represent an object and a purpose in itself, but has to serve the welfare of the human being—which, unfortunately, is a somewhat sensitive creature quite unable to acquire the useful properties of conveyor belt goods.

With this viewpoint in mind, and keeping also in mind that America only started with her sewage disposal work some 150 years after she had firmly established herself as a nation, and considering that the construction of modern sewage disposal plants in U. S. dates not further back than 40 years, one can say in general, after a visit in this astonishingly developed country, that Americans might be well satisfied with the present technical status of their sewage disposal. America appears to have been well served indeed by their men of profession, including the scientists who cleared the chemical-biological jungle, the engineers who erected on the safe ground the things of practical use; and, last but not least, the professional press which so effectively helped to spread the knowledge and the treasures of experience through the continent.

Activated Sludge Developments Impressive

It is a fact that the foreign expert visiting America is instantly and markedly impressed by the development of the activated sludge plants. The stupendous dimensions, as well as the exact working of such plants, as boasts the Sanitary District of Chicago, must lead to admiration of the technical skill involved in such work, as well as of the splendid organization and the daring spirit of the board responsible for this unique development of mammoth drainage facilities. The Chicago, Milwaukee and other big activated sludge plants offer adequate proof that this kind of treatment is the most practical method for complete purification of large cities' sewages. Indeed I can not imagine the large sewage disposal plants of the future to be otherwise schemed than on the activated sludge system, assuming complete treatment to be necessary. There may still arise some operation difficulties in certain particulars; but such are in my conviction of minor importance, and will surely be overcome, because the method in itself is basically sound.

Beside the Milwaukee plant, where was ingeniously solved a difficult site problem, and where was pioneered the conversion of sludge to a dry fertilizer, there is also the marvel of construction called Ward's Island plant in New York, coming in operation in a short time. Amongst a large number of smaller plants are such well designed works as the Northside plant in Toronto, Ont., or Peoria, Ill., or Collingswood, N. J., in which latter plant the surface aeration system renders equally satisfactory results as those of the diffused air system of the larger plants.

What About Trickling Filters?

Are, now, trickling filters obsolete with regard to the triumphs of the activated sludge method? Or, is this method, in the old and in the new world of widely spread treatment, just awakening to a new evolution? I could not get to the bottom of this question although I had the opportunity to see several trickling filter plants and, in addition, some experimental units. Among them were the Chicago West Side filters of the Halvorson and the Jenks type, also another trickling filter of an experimental character in Peoria, Ill.

However, taking in account the history of the trickling filter and the useful services this device has rendered for many years in the disposal of sewage and some industrial wastes in England, America, Germany and many other countries, it seems to me unlikely that it shall disappear from the construction programs of sewage treatment plants of the future. It is my conviction that the trickling filter will remain the suitable biological purification device for medium sized and small plants, provided the local conditions conform with this kind of treatment.

To be sure, the construction and operation of trickling filters suffered for years from some monotony and from carrying certain errors schematically from design to design. It is just such dangers of standardization that may result in stagnation of progress. The spray nozzle has in my opinion only little chance to be still used in future plants; the power driven rotary distributors being in any case more dependable, and far less troublesome. The new experiments (Halvorson, Jenks and others) with the trend to get out of the trickling filter a greatly enlarged amount of work, surely deserve close attention. To judge the definite value of the suggested

*Former Chief Chemist, Emschergenossenschaft, Essen.

methods, on the data already presented, seems to me however to be questionable for the present. From a long experience with disappointments in sewage treatment inventions, I am personally somewhat prejudiced against miracles. The biological action follows, as every process in this world, the laws of energy which can not be overruled by an "invention."

There is an obvious natural sympathy between water and stone, as likewise between water and sand. According to a German popular proverb polluted water flowing "through three stones" regains its original purity. Let the sewage also, in the future, pass "three stones"—stones coated with bacterial slimes.

The treatment on land, still an important manner of disposal in some parts of British isles and recently strongly promoted in Germany, apparently plays no role of importance in America. Yet irrigation of eroded land with sewage may turn out helpful to rebuild, on such land, the grass coating lost by erosion. The so-called sewage "raining" technique, developed in Germany, could easily be adapted for such purpose in America.

My Thoughts on America's Chemical-Mechanical Treatment

As to the "chemical-mechanical" treatment, so much discussed in recent years. After I inspected some plants of this type, among them the pioneer plant in Dearborn, Mich., also the highly interesting recently completed plant in New Britain, Conn., I am not able to change basically the views expounded in my article in the August, 1936, issue of this journal. However, I must admit that there are particular cases in which such treatment may be reasonable in America (not in Germany, of course), especially under such local conditions as in Coney Island, N. Y., where the treatment of a seasonal peak flow of sewage comes in question. Unfortunately I had not the opportunity to see this additional treatment in the named plant, being told that the employment of chemicals in the same coincides exactly with the gentlemen's straw hat season. But, I am able to state that the Heaven authorities responsible for the weather seem to disregard completely this rule, because visiting the remarkable recreation beach of the lucky island, some two weeks before the critical point of time, I already met here a throng of a half a million visitors, or so.

As a splendid achievement, which has come from the development anew of chemical-mechanical treatment, should in my opinion be regarded Laughlin's Magnetite-Filters. For this device may be prophesied a broad employment also in non-American countries. It may prove in various cases to be advantageously useful even without chemical coagulation of the sewage. Keeping in mind that the nonsettleable suspended solids—which are however filtrable—consist chiefly of finely divided organics and, therefore, add substantially to the putrescibility of the effluent, it must appear somewhat strange why the comparatively easy removal of this putrescible constituent of sewage, by means of simple straining filters, was for a long time neglected in the development of sewage purification technique. Possibly, because of biological filters, people have forgotten the useful mechanical filter. Interestingly the filtration of plain settled sewage is also now being introduced in a large new German plant under construction by the Wupperverland (Wupper River Drainage Board).

I was also pleased to see several smaller domestic sewage plants on the water sheds of the city of New York Water Supply (and operated by the Department of Water Supply) in which plants the effluents are finally purified through sand filters and chlorinated. I was able to testify to the crystal clear appearance of these filtered effluents; clearer, indeed, than the water in the small rivers receiving them.

I Marvel at the Work Done by Chlorine

The use of chlorine for the disinfection of sewage-plant effluents may be a matter of course in a country forced to derive the drinking water for most cities from rivers and other surface waters. I was therefore not surprised to find so many sewage disposal plants in America equipped with effluent chlorination facilities. Surprising to me, however, was it to see in what degree chlorination has developed, serving a lot of other useful purposes. In the course of sewage treatment, starting with sewers in which chlorine is called for to prevent the formation of hydrogen sulfide, thus saving the concrete from disintegration. When, proceeding to settling tanks in order to release them from objectionable odors; reducing substantially the fly nuisance on trickling filters; converting waste cans and scrap iron to a coagulant for the chemical treatment of sewage and for conditioning of sludge before filtration or of chlorinating copperas to produce the more effective compound (chlorinated-copperas) for the same purposes. A broad employment indeed, of a likewise cheap and manifoldly useful chemical.

For the introduction of such methods in sewage disposal practice, I am informed that the American Chlorine Institute may boast large merits. That the possibilities of the employment of chlorine, in this practice, are not yet exhausted may be learned from the new achievement of using chlorine gas highly diluted with air for degreasing or deoiling of sewage, as exemplified by the Chlorine Institute experiments at the sewage disposal plant at Woonsocket, R. I.* As the degreasing of sewage, in a preliminary disposal stage is highly beneficial for every kind of afterwards (we treasure the word—Ed.) treatment of the liquid portion, as well as of the sludge (and, may sometimes even prove to be a "conditio sine qua non" in the biological purification) the newest application of chlorine, as demonstrated by the Chlorine Institute, may later on be registered as one of the most important steps forward in sewage and wastes purification progress.

What About Sludge Burning?

The incineration of sludge, of which I have seen examples in Dearborn, Chicago (Calumet), New Britain, is undoubtedly a great achievement, if viewed from the purely technical standpoint. In any case, it may be regarded as an appropriate solution of the sludge problem when chemical treatment of the sewage is employed, as in such cases the sludge loaded with iron salts may not represent a desirable substance for agricultural purposes. Also in plants of such tremendous size as in Chicago, where the disposal of the sludge on land would meet serious difficulties, the trend to incineration appears sound. Basically, however, I am not able to get rid of the feeling that the natural destination of the solids separated from the liquid portion of the sewage is the soil, as the source from which these substances came; and, that the treatment of sludge in the sewage disposal plants should prepare a sludge product most suited for this purpose. From this standpoint—which may be rebuked as conservative or even a backward one—I feel

* The results from these experiments have since appeared in the May, 1937, number of this journal in an article by H. A. Faber.

unable to become friendly toward the burning of sludge, which represents an unnatural (I may even say "violent") handling of a substance which, if treated in the proper way (i. e., digested or "milorganited") and embodied into soil, turns grateful by fertilizing the same, thus helping to produce the foodstuffs maintaining human life.

As to the fear of pathogenic bacteria probably present in sewage sludge, which may serve as an argument pro-incineration, I am not indeed informed whether such fear in America is grounded on actual cases of serious diseases or epidemics traced back to sludge handling. But, in Germany, as a matter of fact, such cases did not occur so far as domestic sewage sludge has come into question. In the digestion chambers any pathogenic bacteria are positively destroyed, there being only one known exception—that relating to the Anthrax bacteria, sometimes present in the wastes of tanneries if the raw hides were not sufficiently disinfected. Anthrax forms spores which resist digestion and chlorination. In the heat of a rotary drier such as used in manufacturing "Milorganite" probably all sorts of bacteria even the spores forming ones are destroyed. For the dangerous sludge of tannery wastes and other industrial wastes, without agricultural use (likewise for car screenings, which are of no use for anything) destruction by incineration may be recommended.

Screenings Comminutors and Grinders

Of course, avoiding screenings completely, by disintegrating these objectional matters by means of grinding machines, is a splendid idea. American manufacturing firms did a valuable job in constructing these machines of which I had the opportunity to see three types in action. All three worked well, perhaps even too effectually, because as I could notice in two cases parts of the screenings were so finely mascerated that a slime was formed, appearing as a slippery floating hide on the surface of settling tanks and carried forth even to the secondary settling tanks of an activated sludge plant. This is of course a matter of minor importance and can be prevented. It may be interesting to mention that a screenings grinding machine, somewhat similar to the Jeffrey type, was used many years ago in Germany, in a Berlin sewage pumping station, being designed by the Wilhelm Wurl machine manufacturing firm in Berlin-Weissensee, well known as the manufacturer of the Riensch-Wurl revolving disc sewage screen. After certain changes in the said pumping station the Wurl-grinder was eliminated; it has not found any broader use in Germany.

Centrifuging Again Appears

The dewatering of sludge by means of centrifuges, is in my opinion, as far as the American practice is concerned an intermediate step in preparing the sludge for incineration. I had the opportunity to see a new American sludge centrifuge in operation as an experimental plant and I was forced to admiration as to the highly skillful construction of these machines. However, the question whether the sludge centrifuges will prove able to compete with vacuum filters serving the same purpose, and already well introduced in sewage sludge treatment practice, cannot be answered before a broader experience as to the economics of operation of the modern sludge centrifuges will be available. It may be mentioned in this connection that the German pioneering sludge centrifuge constructions (employed in Germany only in a few plants indeed) date in their design back to a time where vacuum sludge filters were still unknown.

What About Industrial Wastes?

The high standard of America's cities' sewages disposal does not as yet apply, as a general rule, to the purification of the liquid industrial wastes in this country. The rapid development in the war and the postwar years of various kinds of industry, not practiced before on a broad scale in America, created numerous specific sorts of industrial wastes. Naturally the development of appropriate methods for the treatment of such wastes has been unable to keep pace with the growth of the works in question. So far as I can judge, this problem opens a wide field for the future activities of American sewage disposal men, until now chiefly concerned with the cities sewage disposal practice. As many of the postwar time American industries have for long periods of time already been established in European countries, the American experts might be able to profit through experiences gathered in Europe when it comes to the treatment of some industrial wastes. The difficulty in treating such wastes may be found in the circumstance that the treatment methods must be far more individually chosen for each sort of waste than is the case with city sewage. As a matter of course, a sewage disposal technician confronted with the problem of purification of an industrial liquid discharge, may be inclined to employ some methods and devices already successfully tried in the purification of city sewage. Yet the purification of industrial wastes in various cases must be approached by quite another means, taking into account the quite different character and properties of such wastes as compared with city sewage. They require accordingly technical devices of special types which often must be developed for the purpose. Accordingly, there appears necessary a certain change of the technical mind in viewing the problems of the industrial waste purification. This also concerns the American practice of computing the industrial wastes load in terms of "inhabitants equivalents"; obviously such computation is justified only in the case the wastes in question are of somewhat similar character or similar in "behaviour" as that of city sewage, e.g., the packing industry wastes in Chicago or the fermentation industry wastes in Peoria, Ill.

As I observed, a lot of work had been done already in the scientific investigation of industrial wastes and of the possibilities of treatment. For such research work credit is to be given to various universities, public health authorities and engineering firms. Also some experimental plants were run with partly encouraging results. All this valuable work, while it does not yet suffice to overcome the difficulties which have arisen in various places through the pollution of rivers by industrial wastes, nevertheless means a good start in the matter and justifies the hope that these problems will be mastered by America's professional staff, with comparable success to that attained in the disposal of cities sewages.

High praise and credit is to be paid to the scientific spirit which governs the work of the American sewage disposal men. I found the purification plants provided as a rule with well-equipped laboratories in which scientifically trained personnel executes careful work in testing the sewage and the products of its treatment, in all stages of processes employed. I have seen, in almost every laboratory I visited, some original apparatus for research purposes, skillfully designed and constructed by men of the local laboratory staff. I was very impressed by the abundance of automatic recording devices in the larger plants and by the compilations of operation data accumulated in this way. Certainly such evidence not only facilitates the operation of the single

plant, but also represents a valuable aid in designing plants for other cities, and their future operation. In this respect it may be regarded as a common sense work.

Let me close these few reminiscences of a very instructive travel with sincere thanks to all the gentlemen of my profession—too many to enumerate them here by name—to whom I am mostly indebted for an overwhelming complaisance in explaining to me all details of the plants I was fortunate to inspect; and, in supplying me with such information as I asked for. I must apologize for robbing these gentlemen of their valuable time they lost on my behalf in the office, in the laboratory, on the disposal plants; or, sometimes, very long rides in order to reach the points of inspection. I am deeply indebted to some of my American colleagues, and to their families, for a cordial hospitality they conferred on me. For all this kindness I am not able to offer any other reward than my best wishes for a further prosperous development of the work these gentlemen and their staffs carry on in the interest of American public welfare.

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Experience With Screenings Grinding at Paola, Kan.

By PRESTON MITCHELL

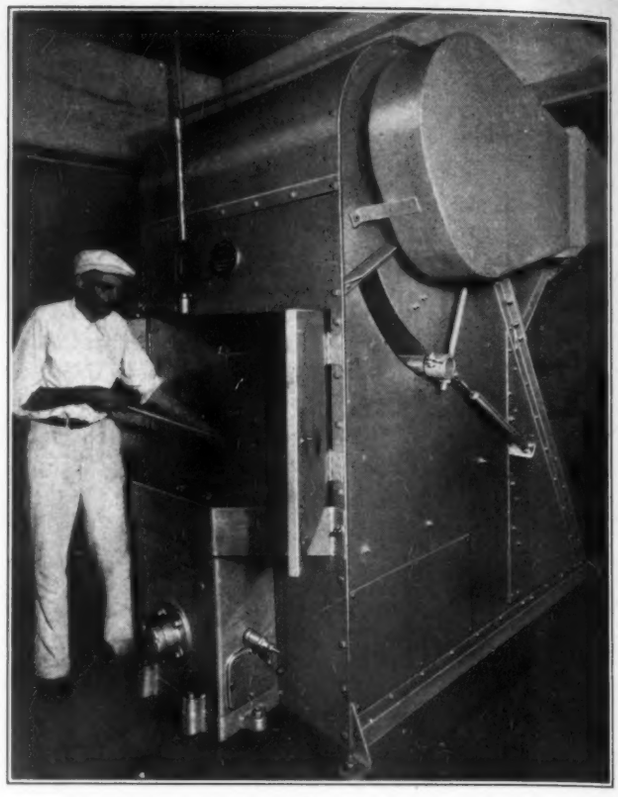
Chief Operator,
Sewage Treatment Plant, Paola, Kan.

SCREENINGS grinding being relatively new, possibly the readers of WATER WORKS AND SEWERAGE will be interested in having information regarding the operation of a new type screenings grinder at our recently completed sewage treatment plant here in Paola, Kansas. The plant has been in operation about 12 months, having started on August 1, 1936. Since that time we have had an average flow of about 350,000 gallons per day, a maximum storm flow of about 1 M.G.D., and a minimum of about 150,000 gallons. The sewage first passes through a bar screen into the wet well for the sewage pumps that serve the plant, which is given complete treatment, trickling filters providing the secondary treatment.

SCREENING AND GRINDING PROGRAM

We operate our mechanically cleaned Rex Bar Screen for one revolution (4 minutes) every hour and we find this is quite sufficient for conditions during any time of the year. The average amount of screenings is from 2 to 3 cu. ft. per day. The maximum amount accumulated in any one day has been 5 cu. ft. The grinder—a Rex "Triturator"—is located beneath the discharge of the screen, with a loading pan intermediate between the two. We let screenings, as discharged, accumulate on this pan until there is a sufficient amount to justify grinding them up. Ordinarily, it is only necessary to operate the grinder once a day for a period of about four to six minutes, but when the daily quantity reaches 4 cu. ft., we find it more satisfactory to operate once in the morning for two or three minutes and once at night for an equal period.

We have no meter record of power consumption of this machine alone, but the motor is a 3 H.P. at 1750 R.P.M. and seems ample for doing the work. Except for rewinding the motor due to submergence in a flood on February 18th, there has been no maintenance expense of any kind, with the exception of routine greasing and cleaning up around the machine. We estimate the spray nozzle furnished with the "Triturator" uses less than 5 gallons of water per minute, while the machine is in operation.



New Screenings Grinder at Paola, Kan., Plant

THE SCHEME HAS BEEN HIGHLY SATISFACTORY

As a summary of the above information, I would say that our screen and grinder has handled about 750 cu. ft. of screenings, or about 20 tons of this material, during the 12 months since the plant was started. The "Triturator" has done a very satisfactory job of grinding up the rags and other screenings. We haven't observed any increase in scum or other floating material that we can blame on it. Teeth, grates, and other working parts of the "Triturator" seem to be in good shape.

This information might be interesting to sewage works operators and engineers, because I believe we had the first installation of this kind of equipment. However, I understand others are now in operation at other plants, but I haven't seen any information regarding their performance and therefore this report is presented.

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Why America's Legs Are Growing Smaller

A comparison of average gasoline prices, including taxes, here and abroad, shows how great an advantage the American citizen enjoys in this respect:

	Per U. S. gal.
Italy	$0.80
Germany	.53
France	.5225
United Kingdom	.3075
United States	.1882

There is an automobile in this country for every 4.8 persons. In Europe, on the other hand, there is one automobile for every 76.4 persons.—From Armco's *Highway Magazine.*

PENNA. WATER OPERATORS ASSOCIATION CELEBRATES 10TH ANNIVERSARY

With Nine of the Ten Presidents on Hand

State College Gets a New Tank. Half Way Up Is the Brick Tower Enclosure, Atop of Which Will Appear the Silver Dome.

THE 10th Annual Conference of Pennsylvania's Water Works Operators Association this year took on aspects of a national gathering. With a battery of "big-gun" speakers invited to help, this 10th anniversary meeting of one of America's livest and largest sectional associations proved to be one of the most interesting and successful.

Customary since the organization of the association, the meeting was held on the campus of Pennsylvania's centrally located State College, where beauty and restfulness abound, where spirit and inspiration come naturally. The official registration of 220, when analyzed, revealed 100 to be operators and managers, 60 to be engineers, 60 to be manufacturers' representatives. Of this balance in attendance the Association can, with justification, take pride.

A feature of this year was the roll-call of the ten members who have served as presidents of the Association. To it, nine of the ten answered "Here!"—a commentary on what this A-1 association means to its members. The tenth was unavoidably absent.

From Chicago came John Baylis to lecture on "Filter Operation"; from Columbus, Chas. P. Hoover to review progress and developments in "Corrosion Control"; from Atlanta, W. H. Weir to take part and represent "Dixie"; from the shadow of the Nation's Capitol, Carl Hechmer to tell of "America's Most Novel Water Plant"—the compact all-steel circular filter plant, designed by the late Robert Morse; from Baltimore, E. S. Hopkins to discuss; and from A. W. W. A. headquarters the Executive-Secretary, Harry Jordan, to compliment "Glace's Pennsylvanians" and tell of the plans of A. W. W. A. in helping water works operators up the ladder of success, through social as well as a technical advancement.

The afternoon golf tournament with the Pennsylvania Sewage Works Association was held between the meetings of the two associations, as recounted in the report of the sewage works meeting in our July issue. A nice interlude between meetings on a not too difficult course the tournament, open to "dubs" as well as the finished player, has come to be a feature of the State College meetings which has out-boomed the firecrackers thrown in the halls of the dormitories by one of the "bad boys," to keep sleepy-heads awake.

Wm. C. Emigh, City Engr., Coatsville, Retiring President

G. Webber Knight, Mgr. Natrona Water Co., Incoming President

Business Session

From live-wire long time Secretary "Mike" Glace came the report that there were 341 active members, 23 corporate, 39 associate; total membership 403. With two sectional meetings in the state each year (East and West), total attendance at all meetings for the year had been 500. Advertising in the Journal and income had picked up, to provide $713.50 balance in the treasury.

Officers elected for 1937-38 are:

President—G. W. Knight, Mgr., Natrona Water Co., Natrona.

Vice-Pres.—J. C. DeGroot, Supt., Clear Springs Water Co., Northampton.

*Vice-Pres.—Chas. J. Bruce, Supt. Evitts Creek Water Co., Cumberland, Md.

Sec'y-Treas—I. M. Glace, Consulting Engineer, Harrisburg.

*(NOTE: The new Vice-President, C. J. Bruce, has also the distinction of simultaneously holding the same office in the Maryland-Delaware Association.—Ed.)

1928 1929 1930 1931 1932 1933 1934 1935

Eight Past-Presidents of the Association

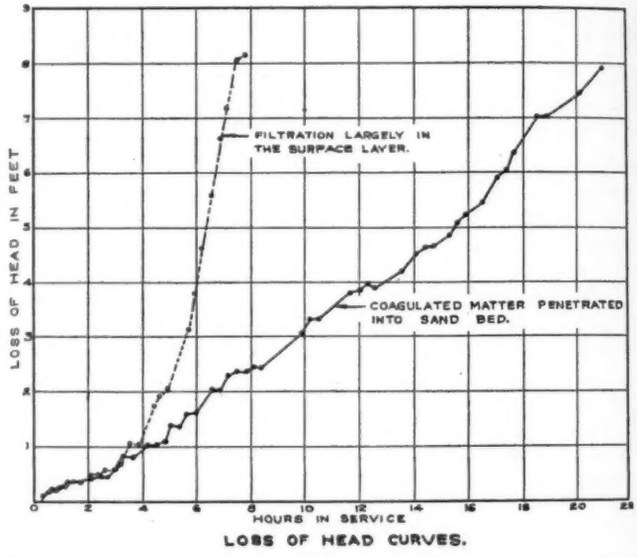
Prof. Elton D. Walker (State College); C. F. Drake (Pittsburgh); J. S. Dunwoody (Erie); Geo. R. Taylor (Scranton); Ed. C. Trax (McKeesport); M. E. Flentje (Greensburg); Chas. L. Fox (Wilkinsburg); H. M. Freeburn (Philadelphia)*

Technical Sessions

The customary evening lecture, on the opening night of the Pennsylvania meeting, was given by John R. Baylis, Chemist in Charge of Chicago's Experimental Filter Plant, and Associate Editor of WATER WORKS & SEWERAGE, as the featured speaker. Mr. Baylis for an hour, with the lantern, spoke interestingly and lucidly on **"Problems in Filter Operation and Maintenance,"** which he knows probably better than any other authority in the field. With the aid of slides he pictured the more common troubles that can, and do, happen to filter beds. He illustrated the work of the sand bed and the functioning of beds of various size sand grains and other materials, including Anthrafilt. A few of the high spots in his talk follow. Based on his findings, and the practical side of every-day experience in preparing water for filtration, Mr. Baylis cautioned that the pendulum was probably swinging too far in the present trend toward coarser grained filter media. He favored, for general consideration, a medium size—(0.55 m.m. effective size or thereabouts) and more attention to raw water preparation, particularly during critical temperature periods. He felt that filters should be washed on the basis of travel of floc (turbidity) through the beds, rather than on loss of head (see graph). To evaluate filter bed performance and raw-water preparation he suggested a small cotton-plug filter through which some of the effluent of each unit should pass. (This filter is described elsewhere in this issue by Mr. Baylis.) He also described the Chicago procedure of evaluating filter washing efficiency by determining mud-ball concentration in samples of sand, taken from the bed with a 6 inch deep "biscuit-cutter" and thereafter washed through a sieve to catch the mud balls for volume measurement in a measuring cylinder. Proving the merits of the Chicago Surface-Wash (developed by Baylis) the mud-ball method of evaluation indicated that, with considerably less wash water, the surface wash (now successfully proven in several plants) held mud-ball accumulations to less than 0.03 per cent of the sand volume as compared with 3.96 per cent for 24 in. ordinary wash rise and 3.13 per cent with a high velocity 45 in. rise. Length of filter runs had been known to increase 80 per cent with surface wash plus moderate up-flow wash.

Sec'y-Treas., I. M. Glace, Harrisburg

Vice-Pres., J. C. De Groot, Northampton


FILTRATION LARGELY IN THE SURFACE LAYER.
COAGULATED MATTER PENETRATED INTO SAND BED.
LOSS OF HEAD IN FEET
HOURS IN SERVICE
LOSS OF HEAD CURVES.

Matte Filtration vs. Contact Filtration (Fine vs. Coarse Grained Media)

On left, curve for trouble-making filter bed. On right, long runs, freedom from bed shrinkage, mud cracks, air binding. Gradual loosening and passage of deposits from upper to lower levels indicated by breaks in head loss line for coarse grained filter beds. Washing determined on first appearance of turbidity in effluent, rather than on loss of head.

In the ensuing discussion, and in answer to questions, Mr. Baylis said that his latest work, involving silicate additions for improving floc, had shown a markedly tougher floc produced with both alum and iron salts. An eight foot bed penetration had been reduced to practically zero, and longer runs recorded. (For details see Baylis articles in recent issues of WATER WORKS & SEWERAGE.—Ed.) As to experience with the porous bottom filter, equipped with the new "Aloxite" plates, one unit had been in service almost two years. The plates, after about six months of service, had been cleaned without difficulty, by simply adding caustic soda

*Residence at time of serving; has been moved to New York City.

John R. Baylis (No. 1 Mud-Ball Enemy)

Harry E. Jordan (to Praise "Glace's Pennsylvanians")

to the unit and allowing to stand. The loss of head during washing had been returned to 1.5 ft. and after again reaching a 5 ft., loss during washing, a second caustic treatment reduced the washing head-loss to 1.75 ft. The treatment was simple and inexpensive, the only question remaining being how long would the method serve before some more effective cleaning (acid, chlorine or re-burning) would become necessary to return the plates to their approximate original porosity. The wash-water distribution and bed cleansing had been very uniform, with nothing in the way of a gravel bed between the sand and plates to assist distribution. Seemingly it was organic matter and alum floc penetration which caused the gradual plate cloggage because dispersion with caustic soda was effective. Chlorine treatment of the plates, applied to the false bottom from beneath, had been considered as an added aid in cleaning if it proved necessary to improve on the caustic treatment.

W. H. WEIR, Georgia Department of Health (Atlanta), in a scheduled discussion, looked back a few years to reflect that the old sand film ideas and the theory seemed ridiculous in the present light of aiming to keep filter sand scrubbed to maximum cleanliness. He remarked on the advantages of essentially sterile beds, and the newer conception of the work of the filter; the advantages of keeping it clean and sweet, involving sand grain scrubbing such as proven by Baylis, and drastic caustic or chlorine applications to loosen sand coatings and sterilize beds at intervals. Mr. Weir listed as helpful manually operated aids in the way of mud-ball "punishers" such as tooth-studded whirling heads, driven by hand-size motors and applied by the operator ahead of the water wash; also, mud-ball "lifters" constructed like long tooth rakes or ¼ mesh wire scoops. He told operators that much could be learned from small-area (1 foot square) observation and study filters with glass side walls.

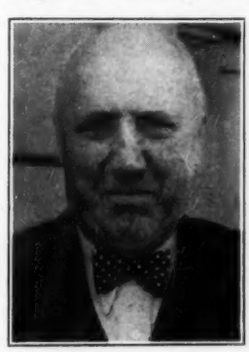
Some question was raised by E. S. Hopkins and H. G. Turner about experimental filters of 2 in. glass tubes giving results as dependable as larger units, particularly in evaluating washing behavior. To this, Mr. Baylis replied that, based on long experience, filters 1¾ in. diam. and larger had given parallel results to the larger experimental units. Questioned as to the soundness of the practice of "jolting" choked filter-beds (a brief partial opening of the wash valve to loosen the bed), Mr. Baylis thought if properly done no harm came from it. Generally, it was not approved. To other questions: Slow closing of the valve after a wash had some advantages in bed grading, perhaps, but had not proved very important. Foam during washing came from release of entrained air. To measure sand bed expansion the use of a disappearing electric light on a measuring rod was possibly the most accurate. Rods, with closely placed sand cups on a graduated staff had been used; likewise had floats, ballasted so as to sink in water but float on the liquefied sand.

Chlorination Problems

GEORGE R. TAYLOR, Chief Chemist, Scranton Spring-Brook Water Co., told of the successful experiment with valuable results accruing from the holding of 5 schools for the 40 men having to do with chlorinator operation and maintenance on the extensive and scattered Scranton system. In the demonstrations of field repair methods and the taking apart and cleaning and assembly of chlorinators, oxygen gas had been used for greater comfort. A chlorinator manufacturer's representative had contributed his time to assist in the demonstrations. The meaning of residual chlorine values and an insight into the bacteriological laboratory work, in routine checking, had proved a valuable part of the courses. The results had been to increase operator interest and his appreciation of responsibility, fewer days of deficient chlorination and a more constant efficiency, with less frequent high residuals. Mr. Taylor himself, and other supervisors, had also learned much. A greater number of the most essential replacement parts had been carried at each station since.

LINN H. ENSLOW and J. C. DEGROOT complimented Mr. Taylor on the Scranton method. Both surmised that it would pay its way in less waste, greater efficiency and less worry to those in responsible charge. Seemingly, it was the outstanding program of its nature in the country. Then followed a general discussion of considerable interest which dealt with the making of residual chlorine tests and their meaning and importance —especially so in Pennsylvania, which has 300 to 400 supplies depending upon chlorination (alone) for safety. In defining the meaning of "excess" as against "residual" chlorine—the term "residual" seemed the proper one in control, whereas "excess" was also an important factor, if considered as that on hand in cylinders and not in the water.

F. E. DANIELS, veteran senior chemist of Pennsylvania's Department of Health, I. M. Glace and L. H. Enslow spoke highly of Scott's permanent residual standards for use in small vials or tubes, at will—especially useful in small sized field test outfits, for which the official standard color solutions of "Standard Methods" could not be used. (Scott's standards are to be found in WATER WORKS & SEWERAGE for November, 1935, p. 399.—Ed.) In making tests for residuals in excess of 0.5 p.p.m., Mr. Daniels suggested dilution of sample. In such event, the orthotolidin solution should be added to the portion of dilution water, and then the sample to make up the required volume. Otherwise, a lowering of residual, in satisfying the demand of the diluting water, would prove a source of error. Color variations such as



Vice-Pres., Chas. J. Bruce (Holds Same Job in Two Ass'ns)

Everett Jones, Ran the Joint Golf Tournament

Chas. P. Hoover, "Corrosion Control" His Contribution

Carl A. Hechmer, Operates America's Most Unique Plant

blues, greens or red-orange signified insufficient O. T. reagent or else that the solution was of too low acidity for the water, sewage, etc., being tested.

H. E. JORDAN said that the works control procedure followed by operators need not be as exact as laboratory control. At Indianapolis the works-standards, used in a less exacting manner every 30 minutes, were checked back against the exact "Standards Methods" procedure in the laboratory.

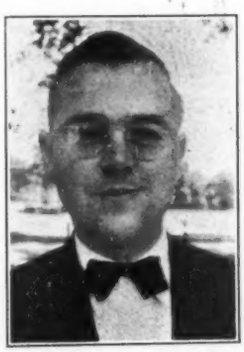
Ralph L. Tyler (Scottsdale), No. 1 Golfer
"Bill" Weir (Atlanta, Ga.), a guest from Dixie
A. J. Richards (McKeesport), His First Convention

LINN H. ENSLOW, answering a question—**"Why do we sometimes find more residual chlorine in the mains than is applied at the plant?"**—stated that such could be due only to an oxidation product. Most commonly it was manganese, possibly iron, and only remotely liable to be due to nitrites in chlorinated potable waters. Filter effluents from dirty beds might give a false residual in warm weather, due to nitrites produced within the bed. Manganese would frequently not show up with orthotolidin ahead of chlorination—the reason being that it was most usually in the lower (manganous) form. When chlorinated it then became manganic and capable of showing a false residual without residual actually being present. More prevalently the false residual was additive to the actual. To evaluate the false and the actual, the most accurate method known was that of R. D. Scott (WATER WORKS AND SEWERAGE, February, 1935, p. 58). It required precipitation of the manganic manganese and iron with sodium hydroxide (aided by magnesium sulphate) and the determination of the available chlorine, which will be left in the clear supernatant. Mr. Enslow said that a manganese or iron error could be approximately determined by bringing the sample to a brief boil to dissipate the chlorine; cool and test for the "blank" to be subtracted from the apparent residual in the unheated sample. (The methods of Scott, above referred to, likewise include procedures for detecting errors due to iron or nitrites, if present.—Ed.)

"Concerning intestinal outbreaks, plant control, laboratory methods, media" — "Standard Methods" seemed sufficient, regardless of the finger pointed at existing laboratory methods by medical men who fail to find an explanation of outbreaks of gastro-intestinal disturbances which by circumstantial evidence are laid to water. H. E. Jordan was strong in his belief that failures, or letdown in operation (possibly false economies), had been the real cause of the trouble and inadequate laboratory control had not caught the failure. Case histories had served to support this belief, and he pled that water operators do all things required. Then the laboratory methods would not be found lacking, in his opinion. In other words, Jordan emphasizes that much water flows from plant to tap between tests at many plants—some receiving only the check-up of commercial or state laboratories.

Corrosion and Its Control

This topic was introduced by Charles P. Hoover, Superintendent of the Columbus, Ohio, water softening plant and internationally known consultant in water treatment. He explained the relationship between the bicarbonate and normal carbonate content of waters which were considered film depositing (protective) and those considered corrosive (dissolving) waters. He briefly reviewed the results of the Columbus studies on household hot water tanks which had shown the need for striking between the high pH, which had attacked hot water boilers and services while laying down deposits in mains and pipes; and the low pH, which resulted in less distress to galvanizing but produced tuberculation of water mains. At Columbus a pH of 9.3 (softened water) had dissolved zinc coatings and corroded steel hot water tanks, while simultaneously laying down deposits of carbonate. On the other hand, a pH of 7.5 (recarbonated softened water) had not. (For details see Mr. Hoover's article in WATER WORKS AND SEWERAGE for October, 1936, p. 384.—Ed.) It was his conclusion that a water in chemical balance (non-aggressive) should lay down no lime carbonate deposits. The problem in treatment was to strike the happy medium between the pitting of hot water piping and tanks, and carbonate depositions, and corrosion and tuberculation of cold water mains and services. In Columbus, mains receiving water of 35 p.p.m. alkalinity (wholly normal carbonates) and pH 9.3 had been choking up, while galvanized hot water boilers lasted only 10 years or somewhat longer. In the future it was proposed to carry not more than 9 or 10 parts normal carbonate alkalinity at Columbus, and hot and cold tests were under way (to continue one year)



Carl Kear (Knowing How to "Take It," the Manager's Greatest Asset)

Geo. W. Naylor (Corrosion and Public Relations—the Literature Hadn't Helped Much)

to select the "happy medium" treatment referred to. In this he believed the ratio between total alkalinity and normal carbonate alkalinity to be the important factor in waters of moderate to low alkalinity, rather than the pH value. For cold water control (tuberculation) the marble-solubility test should apply satisfactorily. (For the method, see Reference and Data Issue of WATER WORKS AND SEWERAGE, May, 1937, p. 217.)

E. S. HOPKINS (Baltimore), scheduled discusser, did not believe that a municipal water utility could devise a treatment to eliminate hot water corrosion which would prove practical, and therefore should be content with treating for cold water troubles. Dissolved oxygen content to him was of the highest consideration and he referred to recent results of de-aeration. (See "Corrosion Control by De-aeration," WATER WORKS AND SEWERAGE Reference and Data Issue, May, 1937, p. 223.) He believed that Hoover was doing a valuable piece of work and had confirmed Baylis' findings, published some years ago. He advocated that the literature should first be searched when undertaking studies of this nature.

PAUL S. ARMSTRONG, City Chemist, Easton, Pa., said that, based on experience, he would rather advocate "Study your own problem and do not let material already published in the literature discourage you." On the Easton water, studies had shown it corrosive to iron at pH 8.4 with total alkalinity of 35 parts. To zinc, the same water was least corrosive. It was his experience that as the total alkalinity (hardness) mounted the pH value for non-corrosion lowered. He had learned the value of studying the problem at hand, regardless of the literature.

JOHN R. BAYLIS (Chicago), in complimenting Mr. Hoover, felt that the literature was frequently confusing rather than helpful. Dissolved oxygen, for example, might be important in non-film forming waters, but it had been shown that no drop in oxygen occurred in cold water systems where the water was adjusted to be somewhat depositing; this, regardless of what the resulting pH might be. Seemingly the range of effective pH values hinged wholly on the quality and quantity of the mineral content of the water. Baylis questioned just where water chemists should stop in treating for hot water troubles; thought that plumbing materials to stand hot water attack might be the more practical solution in the long run.

DR. WILLIAM STERICKER, Chemical Engineer, Philadelphia Quartz Co., in response to the Chair's invitation, reviewed the history and recent progress with corrosion control, involving silicate additions to the water. Particularly effective had the silicate treatment proved in industrial operations, not able to cope with traces of iron in the processing water. The treatment had been first employed to stop solution of lead pipes, and also formed

Dr. Wm. Stericker (Told of Silicates in Corrosion Control)

P. S. Armstrong (Do Not Let the Literature Discourage You)

L. L. Hedgepeth (Take Her for a Dizzy Whirl)

J. B. Baty (Joint Author—"ABC's of Flocculation")

the protective zinc silicate. In the silica coating effect, pH did not enter. The process was attractive on that score in industrial supply and was being used in large buildings and to a limited degree more recently in potable water supplies.

L. L. HEDGEPETH, Pennsylvania Salt Mfg. Co.'s manager of technical service, told of his North Carolina experience with a water of 20 total alkalinity, on which

Filtration Superintendents

R. B. Adams—Penna. Water Co., Wilkinsburg
Harry J. Krum, City Chemist, Allentown
L. S. Duckworth, Plant Manager, Lancaster

lime adjustment to meet the marble test had not proved sufficient. Gradually increasing lime application a pH of 9.4 to 9.8 seemed necessary to control red-water complaints. Hoover had suggested controlling the treatment on basis of total alkalinity and that seemed to answer.

Mr. Hoover at this point stated that in commencing lime treatment it was well to start drastically and coat the pipes quickly—thereafter reduce treatment to meet requirements. I. M. GLACE, however, had a different experience with soft mountain waters, wherein the high lime treatment had caused a shrinkage and loosening of deposits of rust, with justified complaints. It seemed to be "Tuberculation in Reverse" (See Glace article, WATER WORKS AND SEWERAGE for June, 1937). They had started over again with moderate dosages, and with the clearing of the rust deposits some carbonate coating film was now in evidence. Dr. Stericker confirmed the Glace observation, having noted the same phenomena when starting sodium silicate treatment. Mr. Glace later told of the use of limestone contact beds on a small supply wherein the alkalinity was boosted from 10 to 40 and pH from 6.0 to 7.0 or a little better. Mains had been recently cleaned and observation sections of various pipe materials were being carefully watched for results attained.

(1) *M. G. Mansfield, Cons. Engr., Pittsburgh;* (2) *W. H. Eastburn, Mathieson Alkali Wks.;* (3) *E. J. Canton, Badger Meter Co.;* (4) *E. J. Jenkins, Supt., Phila. Suburban Water Co.;* (5) *G. F. Linn, Builders' Iron Foundry;* (6) *E. A. Sigworth, Industrial Chem. Sales Co.;* (7) *C. M. Ogburn, Supt. Johnstown Water Co.;* (8) *Jo. Gilbert, Link Belt Co.*

J. R. HARVEY (Meadville) said that, while he had never found anything about it in the literature, he had learned that one method of lime treatment, namely, putting it into deep wells equipped with bowl-type centrifugal pumps, was wrong. That much came from experience when the impeller vanes of the pump got "protected" with deposited carbonate to the extent that little or no water came from the well. The water was high in CO_2 content and lime, rather than double pumping for aeration, seemed the thing. (Here is ample demonstration that the axiom "Study your own problem" is a sound one. Had caustic soda, soda ash or silicate been used, the scheme would have worked. Combination treatments have thus been effectively used, involving a caustic soda solution containing hypochlorite sufficient to produce the desired residual chlorine and a slight normal carbonate alkalinity—i.e., yellow to ortho-tolidin, pink to phenolpthalein.—Ed.)

GEORGE W. NAYLOR, manager, Gettysburg (Pa.) Water Co., said that he had had his troubles with a surface supply (30 to 40 parts hardness, alkalinity 20), on which lime treatment was started 3 years ago. Raising the pH to 8.2 ahead of a centrifugal pump had given no pump trouble and pumping pressure (main friction) had climbed but slightly thereafter. Finding the friction coefficient to be less than C-40, the mains had been cleaned. However, 6 months later they were back again to the old C value. The pH value had been boosted to 9.4 with neither sloughing nor carbonate deposition showing up. Rather, the distribution pipes seemed to be still tuberculating. The literature (unfortunately) failed to say what he should do next. For an answer Mr. Naylor was in a quandary; got little help from the experts on hand.

"Essentials in Floc Formation," by L. L. HEDGEPETH and J. B. BAITY, Technical Service Department, Pennsylvania Salt Mfg. Co., Philadelphia, Pa.

Presented by the senior author, this paper constituted an illuminating and interestingly colored discussion of the A, B, C's of flocculating and conditioning waters for filtration. Stress was placed on the essentiality of laboratory scale checking (jar tests) to arrive at the most technically and economically correct coagulation. Mr. Hedgepeth cited two cases of complaints of inferior alum, which had been followed up with jar tests made by one of his staff at the plants in question. Without difficulty the source of troubles came to light, viz., low temperature with deficient alkalinity. Temporarily, three to four times the normal alum dosage proved necessary, although the alum proved on analysis to meet A.W.W.A. specifications. Limitations in alkali application and the most effective point were revealed. Increased velocity in mixing had been shown to reduce coagulant requirement by 200 per cent under some conditions. Concerning water works chemicals, Mr. Hedgepeth commended the work of the A.W.W.A. Committee on Specifications for Water Works Chemicals, headed by M. M. Braidech, in bringing about improvements and greater uniformity of products. It was his thought that some standardization of particle size in pulverized alum was needed.

As a basic consideration, efficient water preparation entailed a flash mixing at the point of coagulant addition for uniform distribution and uniform size floc particles. Thereafter a lazy rolling-up motion to produce agglomerated flocs, subject to rapid setting—and, third, leaving good enough alone. Stressing the last, he cited a new plant with highly effective modern mixing and flocculating devices, the good work of which was undone by poor design, resulting in "shredding" the floc to nonsettleable particles while passing from the flocculator to the clarifier.

Mr. Hedgepeth was complimented by the chairman on his unique presentation of so much technically valuable information. Discussion by H. M. Freeburn, H. J. Krum and L. H. Enslow stressed the economy side of efficient mixing and flocculation—not alone in chemicals saved but also in less loading on the filters, less mudball troubles, less wash water required, better quality of finished water.

The Perfect Water Works

CARL KEAR, serious-minded and businesslike manager of the Minersville (Pa.) Water Co., in a philosophical discussion of the public relations aspects of water utility management, said that "the art of knowing how to 'take it' was the utility manager's greatest asset"—always recalling that the average consumer does not like a public utility. Seeking to build friends, they in Minersville had gone far in learning "how to take it," and during the depression service to homes had been discontinued

Ed. Wagner, Downingtown's City Engr., Double Checked His Golf Score, Said It Didn't Help Any; (2) *Morgan (Greenburg) and Fergus (West Newton);* (3) *"Bunk-houses";* (4) *Hess (Lancaster); Sigworth (New York City); Brock (Lancaster)*

in only one instance. An interesting complaint came from a school teacher. Noting a meter dripping, she demanded an adjustment of her bill. Examination showed the "leak" to be sweat dripping from it—so to stop that complaint, and others, all sweating meters and adjoining piping have been brush coated with a mixture of paraffine and vaseline to stop such "leaks." Mr. Kear suggested the value of advertising to build public interest in water supply indispensability, playing up the romance and making heroes of employees. In this, other utilities had been successful to a degree in fighting advertising of the unfavorable sort, and water managers might profit likewise.

"Operating Results of the Robert B. Morse Filter Plant," by CARL A. HECHMER, Department Engineer, Washington Suburban Sanitary District, Hyattsville, Maryland.

Mr. Hechmer, in an exhaustive illustrated paper, described the unique and compact (all-steel welded) circular filter plant at Burnt Mills, Md., recently named for the late designer, Robert B. Morse. The first unit of 5 m.g.d. capacity, now in its fourth year of service, had been duplicated by a twin unit of like diameter (100-ft. circles) containing filters, coagulating basins, clear water storage. Examinations had shown no metal deterioration, the steel being protected with Bitumastic enamel below the sand level, Bakelite enamel on other submerged parts, grey synthetic paint on exteriors. Interesting features—the false filter bottoms of Trilock grating, low head loss, good distribution, no mud-ball troubles; average filtered water turbidity 0.1 to 0.2 in 1936 (max. 0.5 p.p.m.); 40-hour average runs, 1.76 per cent wash water. Of interest to visitors—The lighted central circular filter effluent sight well with black and white tile bottom. Of interest to engineers—Compact operating gallery, outdoor filters, no pipe gallery, cork pipe insulation and acoustical wall treatment; cost of construction, $12,400 per m.g.; cost of operation, $34 per m.g.

Between Sessions on the Campus

16th Ohio Conference Report on Water Purification

(A Review)

The Report of the 16th Annual Ohio Conference on Water Purification has recently been issued. In addition to containing papers and discussions before the Conference in its 1936 meeting there is included an index of the 15 preceding reports of this conference.

Prior to 1932, these reports were published by the State Department of Health, which has always sponsored this organization, but during the past five years the Conference has financed these publications. Inasmuch as advertising is not carried in the reports, it has been necessary to make a charge for the report to all who do not attend the meetings and pay the registration fee.

Amongst the important papers are those on "Mottled Teeth in Ohio" and "The Occurrence and Significance of Fluorides, and their Removal, in Ohio Water Supplies." The paper on "Corrosion Studies in Hot Water Tanks," by Chas. P. Hoover, presents some new ideas in the corrosion problem. "Graphical Aids for Making Calculations" describes the use of homographs and Pearson's Squares in rapid calculation and solving problems arising in the water-works laboratory. "Operation of the Sub-surface Filter and Washing System at Toledo," by Furman, gives the results of several months experimental data, using this new method patented by Ira Jewell.

"Advantages and Disadvantages of Various Iron Removal Devices" is a paper which points out the experiences in iron removal in several Ohio communities. Strickland's "Ten Years in Water Purification," gives operating experiences at the Windsor, Ontario plant, in which some new ideas in water treatment are advanced. This paper is thoroughly scientific and includes a bit of philosophy, of which there might well be more in technical papers.

The digest of "A.W.W.A.'s Recommendations for Handling Dangerous Water Purification Chemicals" is largely a repetition of the A.W.W.A. Committee Report to the A.W.W.A., presented for the purpose of bringing this important matter before the Ohio water-works operators.

Under "Round Table Discussion," several interesting subjects are discussed. Among the more important were the following.

1. "Freezing Difficulties at Water Purification Plants."
2. "Ohio River Flood (1936), Effect on Water Purification Plants."
3. "Effect of Applying Activated Carbon Prior to Filtration at the Columbus Plant."
4. "Effect of Various Types of Water on Vegetation."

Copies of the Report of the 16th Annual Ohio Conference on Water Purification may be obtained from the Treasurer, Glenn Green, 216 So. 12th St., Cambridge, Ohio. The price charged ($1.00), considering the value of the Ohio Conference Reports, is not out of line. Copies of some of the earlier reports are available at the same price.

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Allen Made Superintendent Pasadena Plant

W. A. Allen, for several years assistant superintendent of the Tri Cities (Pasadena) Sewage Treatment Works, serving South Pasadena and Alhambra also, has been made superintendent. Mr. Allen is an active member and a past-president of the California Sewage Works Association. He succeeds A. W. Wyman who recently died.

COMPARING FILTERING EFFICIENCIES

By Determining Small Amounts of Coagulated Material in Effluents

By JOHN R. BAYLIS[1]
Associate Editor

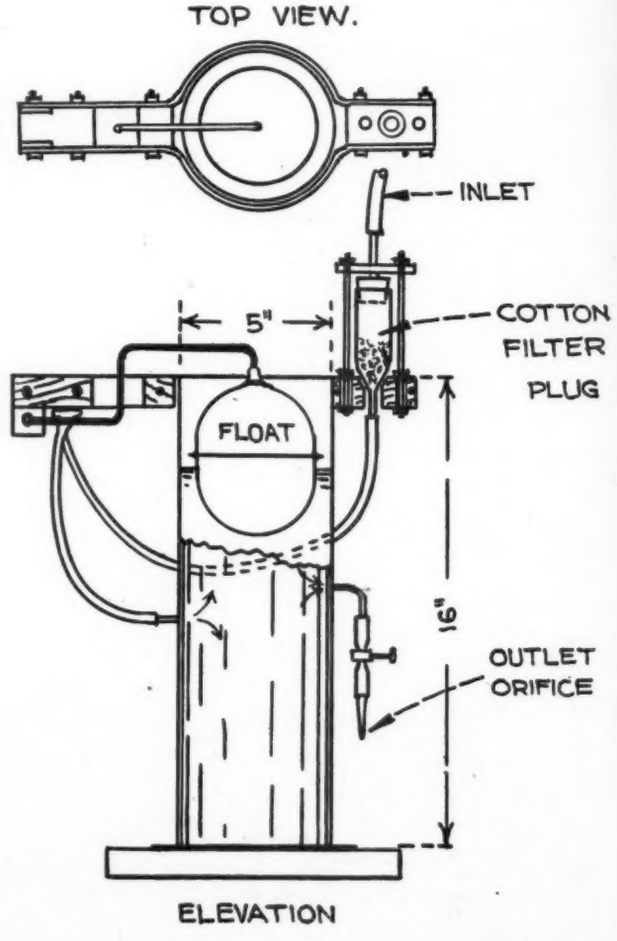
IN EVALUATING filter design and performance, it becomes essential to have some means of determining extremely small amounts of suspended matter in the filtered water if one is to compare filters accurately. Some filter operators are advocating the use of coarser filtering material than has been used to any appreciable extent heretofore. They justify the use of such material on the fact that the water appears to be good when tested with instruments now in use. If turbidity determinations are made on a series of filters and the results recorded zero, no comparison can be made except to assume they are all producing equal results. Sometimes it is known that this is not the case, yet if the difference is beyond the limit of the measuring test or instruments used, there is no way of recording a difference which has actually been found to exist.

Instruments for Comparing Filter Effluents

Considerable thought has been given to the development of some device which will give more accurate comparison of the water from the various filters. To obtain such a comparison it is desirable to accumulate and weigh all of the suspended material passing through in a large volume of the filtered water. This may be accomplished by filtering a portion of the filtered water through a type of filtering media which will retain broken up coagulated material as film from the grains of filter material that passes through the plant filter. Various kinds of filters were considered, but as the amount of material removed has to be determined in very minute quantities, not many filters are suitable. Best results at the Chicago Experimental Filter Plant have been obtained by using a cotton plug filter and burning the cotton together with the material filtered from the water and comparing on the basis of the residual ash content.

The accompanying sketch shows the construction of a filter which is believed will give satisfactory results. The filter is a funnel-tube about 25 mm. inside top diameter, and is listed in nearly all chemical supply catalogues. The cotton plugs are some definite weight, usually 1.0 gram. (approximately) of absorbent cotton. A rubber stopper with device to hold the stopper in place is used to close the filter. The filter part is simple, but the flow through the filter should be kept constant and some dependable means of regulating the flow is essential. The filter connects to a cock on the plant filter effluent line, by use of small rubber tube.

After the water passes through the cotton plug, it then flows through another rubber tube leading to a float chamber. The float lever is fastened as shown—(see cut). The rubber tube passes over the float lever near where it is fastened to the stand so that when the float rises the rubber tube is pinched between the lever and support and reduces the flow of water. With an outlet orifice from the float chamber, calibrated to a definite flow, the device will give a constant flow of water regardless of the head on the plant filter effluent, so long as there is sufficient head to force the water through the cotton plug. The cotton plug should be packed so tightly that a considerable head is required. Pipe galleries are usually deep enough so that when the filters have reached their maximum loss of head the pressure head at the cotton plug filter is still several feet. Where this is the case, there is no difficulty in maintaining a constant flow.



Cotton Plug Filter with Control Apparatus

[1]Physical Chemist, Dept. of Public Works, Chicago, Ill.

The coagulated material gradually accumulates in the cotton plug. A rate of flow of about 100 cc. per minute has been used in our work and found to be satisfactory. This will accumulate a measurable amount of sediment within about 24 hours, though it is advisable to run longer before replacing the cotton plug, so that the weight of sediment may be determined more accurately.

Laboratory Procedure

The procedure is to make record at the time the plug is inserted, see that the filter is operating at the desired rate, and allow it to run for periods of 3 to 8 or 10 days. The cotton plug is then removed, dried, burned in a platinum dish, and the weight of ash determined. The accompanying data shows comparison of the water from several filters when filtered through cotton plugs. The results are given as ash residue. About 190 gallons of water will pass through the cotton plug, when operated 5 days at 100 cc. per minute. The data show considerable difference in the amounts of material retained in the plugs, which amounts are believed to give true comparison of the efficiency of the filters. Checking by other methods of testing did not reveal such a difference in the quality of the filtered water.

The ash content of absorbent cotton is not great and for one-gram portions of cotton may be neglected unless accuracy greater than seems necessary is desired. After placing the cotton plugs in the filter, the plug is wet and packed loosely into the filter with a glass rod. The cotton should not be packed to the extent that there is considerable friction loss through the cotton. The rate of water running through the filter should be something more than 100 cc. per minute free flow. The plug appears to remove all of the coagulated matter which remains in the water after passing the plant filter, though there is not specific proof that this is the case. At least there is an accumulation of material in the cotton plug for all filters, and it is believed that variation in the amount accumulated gives good comparison of the amount of coagulated material passing the plant filter.

COAGULATED MATTER PASSING EXPERIMENTAL FILTERS

(Caught in Cotton Plug Filters)

	—Parts Per Million of Ash*—			
	No. 6— 6 Inches of Sand— .49 mm.	No. 13— 24 Inches of Sand— .60 mm.	No. 19— Crushed Glass— .45 mm.	Plant Filter— .50 mm.
December, 1935...	.060	...	.048	.021
January, 1936...	.096	.060	.030	.021
February, 1936...	.100	.049	.022	.020
March, 1936...	.073	.051	.026	.024
April, 1936...	.083	.097	.045	.030
May, 1936...	.069	.059	.022	.019
Average	.080	.063	.032	.023

*Monthly averages.

Note: All of the water from the glass tube filters passed through cotton plug filters. The cotton plug filter attached to the plant filter was set to operate at 100 cc. per minute.

▼

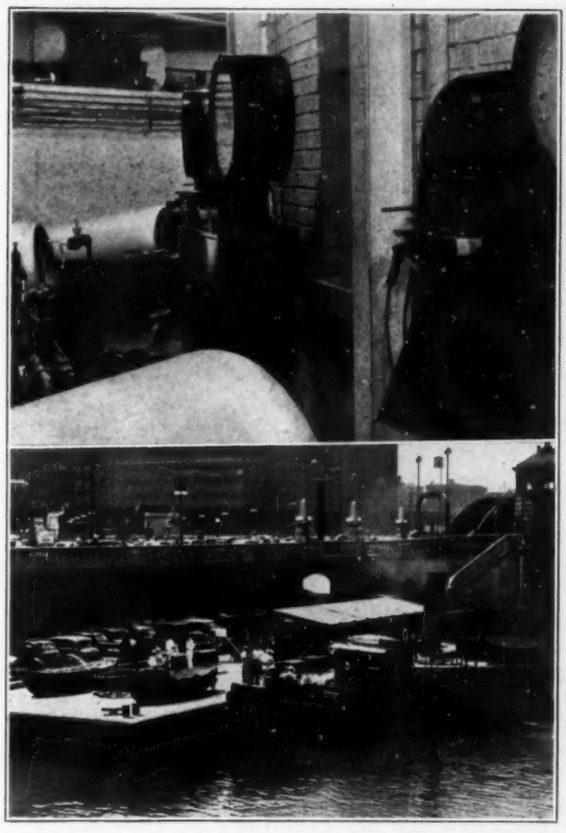
Thomas F. Maher Dies

Mr. Thomas F. Maher, president of the Chapman Valve Manufacturing Company of Indian Orchard, Massachusetts, died July 29. Mr. Maher was widely known in water works and manufacturing circles, and his passing will be lamented by many, both within and without his company.

West Shore Ass'n Inspects Chicago's Dunne Crib Chlorinating Installation

During a typical midwestern heat wave, 80 members of the West Shore Water Producers Association on July 15th left their peak-load troubles long enough to visit Chicago's recently completed unique chlorinating plant, several miles out in Lake Michigan on the Dunne Intake Crib. Unique in purpose, design and control, it is probably the only station of its kind in the world.

This high capacity plant, involving the use of one-ton chlorine containers scowed out to the crib, and ammoniation with sulphate of ammonia, treats the water for about one-third of Chicago—maximum rate of demand on this



tunnel being roughly 5 m.g.d. The dosages are controlled from a testing booth on the mainland at the pumping station supplied by the tunnel. The treated water is almost constantly tested for chlorine residual, and dosages desired are telephoned to the operating crew on the crib, based on changes in pumping rates and the residual tests. A minimum of 0.4 p.p.m. residual is maintained at the pumping station to insure results with the ammonia-chlorine treatment during the contact period afforded by the tunnel.

The accompanying pictures show the awning equipped scow arranged for by the host, Chairman H. H. Gerstein, and the recording scales and ton-containers at the crib—each being placed in its thermostatically controlled water bath to maintain a constant pressure at varying rates of chlorine feed. (For the photographs we are indebted to H. E. Hudson Jr., Chicago Exptl. Filter Plant.—Ed.)

The Original Gastonia Plant (W. M. Piatt, Designing Engr.), One of the Earliest American Activated Sludge Plants. Was Built in 1921; Added to in 1927; Upset by Mill Wastes in 1933.

FERRIC IRON COAGULATION AS AN AID IN AN ACTIVATED SLUDGE PLANT

Upsetting Effects of Textile Mill Wastes Corrected with Ferric Cholride

By J. H. HENDERLITE, JR.
*City Chemist**
Gastonia, N. C.

IN THE SPRING of 1931 the activated sludge plant at Gastonia, N. C., was suddenly plagued by the appearance of highly colored wastes from three textile dye plants that were built and put in operation almost simultaneously. The wastes consist chiefly of sulphur, vat, and direct dyes and vary in color from deep black to bright red and yellow with all the intermediate steps well represented.

The plant effluent was highly colored as well as the receiving stream, which is normally only about two or three times the volume of the effluent. The Gastonia sewage is normally rather weak and the effect of this dye entering the plant in concentrated batches was such that the activated sludge process was disrupted. The sulphur dyes sometimes have an immediate oxygen demand of several hundred parts per million compared with a five day demand of about 100 parts per million for the normal raw sewage. The suspended solids and B.O.D. removal suffered and sludge bulking was a serious problem.

A number of laboratory experiments were conducted on the raw sewage, effluent, and aeration tank liquors using various coagulants. Dosing with ferric chloride at the influent of the plant seemed to be the best method of treatment and it was begun on a plant scale in July, 1933. The results were more satisfactory than the laboratory experiments indicated and the dosage was cut to about half that found to be the optimum laboratory dosage.

Method of Applying Ferric Chloride

The ferric chloride is fed from a concrete solution box into a manhole at the junction of the two trunk sewers at the treatment plant. From this manhole the sewage flows about fifteen feet to an airlift pump which lifts it about six feet directly into the aeration tanks, without primary sedimentation. The passage through the airlift provides an intimate and rapid mixing of the chemical with the sewage.

As before stated, the dyewastes are discharged in concentrated batches into the sewers, and the sewage is dosed at the rate of 500 to 600 pounds of crystal chloride ($FeCl_3:6\,H_2O$) per million gallons during periods when the wastes are entering the plant. On an anhydrous basis this would be 300 to 360 pounds of ferric chloride ($FeCl_3$) per million gallons.

The dye is precipitated in the aerating tanks along with the formation of the activated sludge and is removed in the final settling tanks and dewatered on vacuum filters along with the wasted activated sludge.

Results

The treatment results in a 75 to 90 per cent reduction in the color of all except the direct dyes, which are only slightly affected. This is no doubt due to the fact that the direct dyes are in better solution and consequently are not coagulated as easily as the more colloidal sulphur and vat dyes. However, due to the fact that sulphur and vat dyes are soluble only in the reduced state large amounts of sodium sulphide and various sulphites of soda are used in the baths in which they are dyed. Unless sufficient air is provided in the aeration tanks to oxidize these compounds they reduce the ferric iron to the ferrous state in which it becomes useless as a coagulant.

Additional Benefits Realized

In addition to removing a large amount of the color, the ferric chloride does much to overcome some other evils. There is an increase in the removal of B.O.D. and suspended solids, and sludge bulking in the settling tanks has been eliminated completely.

But lest the reader should think a panacea for all ills has been found, it would be well to say that there are limitations to the treatment with ferric chloride. As has

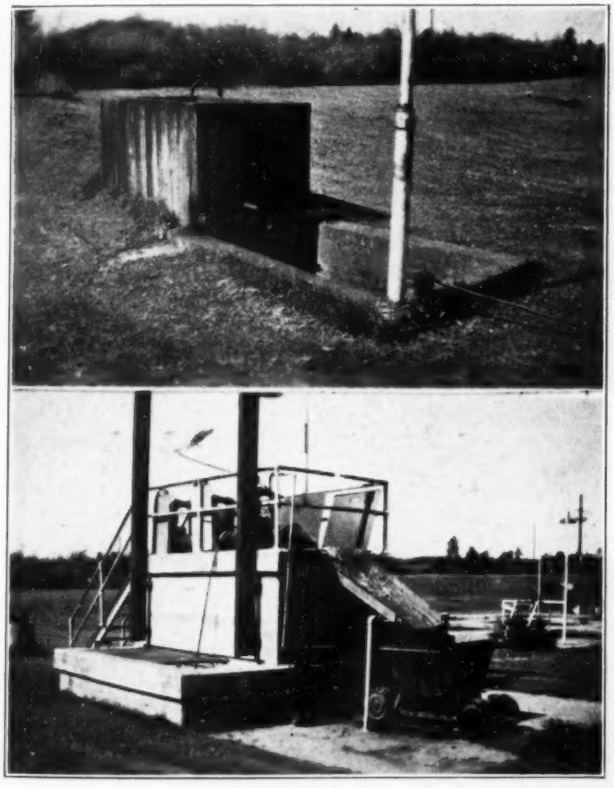
*In charge of Water Purification and Sewage Treatment.

been stated the action on direct or substantive dyes is extremely limited. Then, too, the sewage flow has almost reached the capacity for which the plant was designed and for 6 to 10 hours each day at times of peak flow it exceeds this rate. Although it is still capable of good purification on ordinary sewage, the amount of dye which can be treated successfully, even with the aid of ferric chloride, is limited without the use of higher chemical doses or greater amounts of air which are not considered economically justifiable.

Cost of Treatment

If the dye flow were continuous and dosing, at the rate now used, had to be maintained throughout the entire 24 hours the cost of the ferric chloride would be prohibitive, amounting to the sum of $11 to $13 per million gallons. However, the dye flow only averages 8 to 10 hours a day for five days of the week, with an occasional 3 or 4 hours on Saturday. Consequently, the added chemical cost for 33 months, for which figures are available, has averaged $2.36 per million gallons, based on the total sewage flow, and a price of $2.25 per hundred pounds for crystal ferric chloride. This represents an added cost amounting to 6.5 per cent of the total operating cost.

To summarize: The activated sludge plant at Gastonia is overcoming, to a major extent, difficulties created by the discharge of textile dye wastes into the sanitary sewers, through the expedient of adding the effective coagulant—ferric chloride—to the combined sewage and waste reaching the plant. The cost, which may appear high to some, is not considered excessive when realizing the improved results, better plant control, and the condition of the receiving stream since introduction of the iron treatment as an operating aid to the activated sludge process at Gastonia.



Above—The Ferric Chloride Solution Feed Box at the Treatment Manhole at the Plant. Below—The Air Lift and Screen Station, Just Beyond. It Serves as an Efficient Flash Mixer in the Iron Treatment; the Aeration Tanks as Flocculators.

Professor Talbot Receives John Fritz Medal

(Highest Engineering Award)

Dr. A. N. Talbot

Arthur Newell Talbot, professor emeritus of engineering in the University of Illinois, was awarded the 1937 John Fritz Gold Medal, highest of American engineering (The Medalist) honors. Professor Talbot, who is 79, was cited as "moulder of men, eminent consultant on engineering projects, leader of research, and outstanding educator in civil engineering."

The award is made annually for notable scientific or industrial achievement, by a board composed of sixteen past-presidents of the four national societies of Civil, Mining and Metallurgical, Mechanical, and Electrical Engineers.

To Professor Talbot have already gone numerous other awards, medals; also, honorary degree from the Universities of Pennsylvania, Michigan, Illinois. Of the American Society of Civil Engineers he is a past-president.

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Twin Cities Sanitary Plant Now Fifty Per Cent Finished

The Twin Cities sanitary district sewage disposal system at Pig's Eye island will be open May 1, 1938.

That was announced early in August by C. C. Wilbur, chief engineer in charge, who said the plant is at present 50 per cent completed.

The pump and blower building is nearly finished but only excavation work has been started on the filtration and incineration plant. The sewer construction is 90 per cent completed.

Mr. Wilbur pointed out that the $15,000,000 system would handle the sewage of both cities but in times of storm and overflow sewage will flow into the river through the present sewage outlets.

The Federal Government is financing 30 per cent of the cost, Minneapolis, two-thirds, and St. Paul one-third of the remainder.

▼

Lloyd Setter Joins N.Y.U. Faculty

Dr. Lloyd R. Setter, assistant in water and sewage research under Dr. Rudolfs at Rutgers University, since 1931, has recently been appointed instructor in sanitary engineering at New York University under Professor Lewis V. Carpenter, head of the Department of Hydraulics and Sanitary Engineering. This information comes from Dr. Thorndyke Saville, Dean of Engineering, and former head and organizer of the Department.

From the University of Wisconsin Dr. Setter came to Rutgers College where he received M.S. and Ph. degrees, having specialized in water and sewage research. He has since done considerable investigative work of value, including direction of the laboratory work in pollution surveys of the Delaware and Brandywine Rivers. He has been a contributor of note to sanitation literature, and has appeared frequently on programs of sewage works associations.

SANDY WELLS ARE THE TOUGH ONES!

By MIKE WALTERS*
San Francisco, California

Pumping water from deep wells containing sand in suspension is apt to cause much trouble unless great care is taken in the design and construction of the pumps to prevent excessive wear. The abrasive sand causes excessive wearing of pump parts, especially the sealing section, located between the impeller exit (high pressure side) and the entrance (low pressure side). Shaft and bearings, amongst these parts, are frequently unprotected against sand wear in the majority of available pump designs.

In the early days of deep-well pumping the so-called "air-lift" systems were usually employed. These installations are now virtually extinct because of their well-known inherent low over-all efficiencies. The "air-lift" system has, however, one outstanding advantage in that no moving parts are in the well, and hence there is no resulting wear. Over half a century ago the Krogh Manufacturing Company and also the Kimball Pump Company manufactured and sold many "air-lift" systems.

During recent years, deep-well turbine pumps have made remarkable progress in the field of water pumping, principally because of their high pumping efficiency and resulting lower cost of water produced. The major problem of the manufacturers of deep-well turbine pumps, today, is to find ways and means of preserving these high efficiencies against sand wear. High pumping efficiencies which are not enduring may lend themselves nicely as sales arguments, but the pump-wise purchaser will demand design and construction features inherently adequate to maintain sustained efficiency over the greatest possible time. A sound practice, more and more advocated by thoughtful pump manufacturers and informed pump buyers, is to properly develop a new well by placing a temporary pump in it, thereby preventing excessive initial sand wear. This thoughtful precaution not merely eliminates most of the sand from the well, but also predetermines its capacity before making selection of the permanent pump with the most efficient characteristics.

With regard to the deep-well turbine itself, many design and construction features have been incorporated, of which some of the early ones proved inadequate. Others have yet to establish their efficiencies and a few appear to meet the requirements. Hard-surfacing materials applied to the parts most sensitive to sand wear have not adequately prolonged their life. In some designs use has been made of end-adjustments, similar to those used in dredge-pump practice for many years. The scheme has not proved practicable, however, because of the many stages in which uneven wear is certain to take place in multi-stage pumps. In a dredge-pump but one stage needs adjustment. Some manufacturers utilize "open impellers with end-adjustments. The design of this type affords the advantage of being able to bring back a substantial percentage of the original efficiency when carefully adjusted. In this scheme, a distinct disadvantage, however, lies in the loss of capacity if several adjustments are necessary, since impellers will wear narrower with each adjustment. Uneven wear on the several stages makes this procedure of doubtful adequacy.

The natural question arising from the study of this problem is, of course, "What is its solution?" In our own laboratories as well as in actual field practice, we have designed deep-well turbines which have actually proved themselves to be remarkably safeguarded against sand wear. However, inasmuch as it is sound engineering to allow an adequate period and sufficient tests to warrant acceptance of design advances as adequate and, furthermore, since the expenditures and efforts directed into these channels are extensive, premature broadcast of expected results would defeat its own end.

All sincere deep-well turbine manufacturers, as well as buyers, are more interested in "sustained" performance than in abnormally high initial efficiencies. High initial efficiencies, as a matter of fact, are produced by the pumps of all leading pump manufacturers. In the writer's opinion any definite progress toward more dependably accomplishing a reasonably high efficiency which can be "sustained," will result in very worthwhile benefits to the user. In this connection it seems in order to caution the purchaser of deep-well turbine pumps to look carefully into their intrinsic possibilities for resisting sand wear, for sand is the greatest enemy of the turbine type deep-well pump. In sandy wells, the consideration of installing a temporary pump can not be overstressed.

*Chief Engineer, Kimball-Krogh Pump Division, Victor Equipment Co.

Bond Sales Net PWA $10,000,000 Profit

Local communities voluntarily put up over $1,500,000,000 as their share of the federal-local partnership under PWA to secure permanent useful public works and unemployment relief.

Local subdivisions of government have furnished 66 per cent of all costs of the non-Federal Public Works Administration programs, according to a special report made to Administrator Harold L. Ickes. This brings PWA's contribution in the construction of enduring and service-giving public improvements, including water works and sewerage, down to an average of 34 per cent.

Non-Federal applicants furnished a total of $1,577,964,465, making possible civic improvements estimated to cost $2,339,307,721. PWA's grants totalled $721,343,256.

The percentage of local contribution has varied. Under the first program PWA was authorized by Congress to grant up to 30 per cent of the cost of labor and materials, while under the following two programs, PWA was instructed to grant up to 45 per cent of all the items involved in public construction, which included equipment and also the purchase of property.

Applicants furnished, in hard cash, $922,084,799 either from their own coffers after self-imposed taxation or through issuance to private investors of bonds (many of the utility type) they voted. PWA, in its role of lending agency bolstering local credit when the municipal bond market was impaired, lent $744,879,666 to applicants—in addition to the outright grant money.

All PWA loans were reasonably secured. Through RFC, which acts as its broker, PWA has been selling securities held to the revived municipal bond investing market at a profit. The profit already actually realized by the government in this operation is $10,000,000. PWA has delivered bonds valued at $500,336,146. It still holds $131,631,530 worth of bonds in its vaults. The amount of interest collected by the Federal Government on PWA loans now exceeds $19,393,000.

SLUDGE DISPOSAL BY INCINERATION

PART IV—Power Development

By PHILIP B. STREANDER*
Consulting Engineer

This is the fourth and final installment of a continued article, by Mr. Streander, which deals with the theory and present day practices as applied to the incineration of sewage sludges.

The first installment, which appeared in our January, 1937 issue, discussed modern methods of dewatering or drying sludges, preparatory to incineration. The second, which appeared in the April issue, discussed the heat values of sludges of various types and described incinerators of the mill-type. The third, published in June, described and discussed features of the incinerators of the multiple-hearth type, in which the sludge is both dried and burned with the aid of mechanical rabbling (raking) from hearth to hearth.

WHEN sewage sludge is digested, it is expedient to develop power by the utilization of the gas to operate gas-engines driving either electric generators or connected to some particular operating unit such as air compressors, pumps, etc. Where power is produced from gas it is usual practice to circulate the engine cooling water through the digestion tank heating coils and in some cases to install waste heat boilers on the gas engine exhaust to recover a portion of the heat ordinarily lost, this hot water being combined with the engine cooling water for tank heating. It is not always possible to use all of the gas produced for power production because a portion of it may be required for the heating of the digestion tanks. However, even with this deflection, considerable power can be degenerated, the amount of course being directly dependent on the size of the sewage treatment plant and the local temperature conditions.

In the incineration of sludge it is also possible to generate a considerable amount of power, particularly where the sludge is mechanically dewatered to a low moisture content and particularly in plants of large capacity. It must be remembered that the volatile solids in the sludge constitute the source from which gas is produced. During digestion this volatile matter is reduced from an initial content, averaging 65 to 70 per cent, to a final content, averaging 30 to 35 per cent. Therefore, about 65 per cent of the potential heat values of the volatile matter goes off in the gas produced, the balance remaining in the sludge leaving the digestion tank. With incineration, it can be seen that all of the heat value in sewage sludge is available for heat production. Then, theoretically at least, more heat units can be recovered by complete combustion than by digestion and recovery of heat from the gas alone. This of course is largely affected by such practical considerations as the quality of the sludge, moisture content of the sludge cake, the effectiveness of heat utilization in the incinerator, the efficiencies of the waste heat boilers and the prime movers, etc. These further are influenced by type and capacity of the sewage treatment plant.

*Of Watson & Streander, Engineers, New York City.

Plant Capacity for Power Production

The factor of plant capacity and degree of treatment, reflected in the amount of sludge to be burned, is probably the controlling element in the question of power production. In small plants, with limited treatment, power development is not indicated. Just where the dividing line may fall will depend to a large extent on the ability of sludge dewatering equipment to deliver a sludge cake having a low moisture content, and also on the efficiencies to be obtained in the evaporator and incinerator units. The cost of electric power required to operate the sewage treatment and sludge disposal plant is naturally a factor in the economics of power production through sludge incineration. When power costs are low, say below one cent per K.W.H., the additional fixed, maintenance and operating costs, due to the inclusion of waste heat boilers and prime movers, may more than offset any savings that can be indicated by power production. Likewise where power costs are high power production by waste heat boilers and prime movers may effect considerable savings and economies in plant operation. Each installation must therefore be carefully studied before any definite conclusions can be drawn.

There is roughly indicated in Figure 17 the influence of the moisture content in the sludge and the development of a surplus or deficiency in B.t.u.'s. The information shown is based on the burning of one ton of dry sewage solids per hour, having heat values ranging between 4,000 and 8,000 B.t.u.'s and sludge densities of between 40 and 15 per cent. The surpluses and deficiencies shown are based on combined evaporation and incineration efficiency of 55 per cent, this representing a probable average of the incinerators now available. The B.t.u. surplus and deficiencies are shown on the left-hand side with the approximate pounds of steam produced from surplus heat. Coal required for deficiency is shown on the right-hand side.

Another factor bearing on power production is the efficiency or amount of steam required for the prime movers. Low capacity steam turbines, usually built as non-condensing, require about 70 pounds of steam per K.W. output capacity. About 55 pounds of steam is needed per K.W. for simple high-speed non-condensing steam engines. These rates apply up to about 750 pounds of steam per hour. As the amount of steam produced by the incinerators increases, the amount of steam required per K.W. developed (the steam rate), decreases until it reaches a rate of about 16 pounds per K.W. for steam volumes of 22,000 pounds per hour when using condensing type turbines. Settled or treated sewage can undoubtedly be used as the condensing medium if single-pass, divided water wall condensers are used. In Figure 18 there is shown the approximate kilowatt output capacity of steam turbines direct connected to electric generators. Approximations of power that can be developed can be taken from Figure 18 and, therefrom, determinations made regarding the practicability of power development for the conditions being considered. It will undoubtedly be found that for

sludge having a solids concentration under 30 per cent and with heat values less than 7,000 B.t.u.'s per pound dry solids, that power production is not feasible irrespective of plant capacity. With a dewatered sludge cake having a density of about 40 per cent, and a heat value (dry basis) of 7,500 B.t.u.'s per pound, it may be found that power production will probably be feasible when burning between 15 and 20 tons of dry sewage solids per day. Again this is controlled largely by the cost of electric power at the treatment plant.

Power Generation in Large Plants

With a dense sludge cake (about 40 per cent concentration) a high heat value of sludge, and a sewage treatment plant of such capacity as to require the incineration of 50 to 100 tons (dry-basis) of sewage solids, there is indicated the possibility of being able to operate generators having outputs of between 800 and 2,000 K.W. To show this possibility a study was made covering the incineration of 80 tons of dry sewage solids in 24 hours. While the conclusions, which may be drawn, are at the present time tentative and must be substantiated by further experimental work, it is indicative of what may be accomplished.

To further bring out the necessity for study and development of efficient and economical means of sludge dewatering the study is based on incinerating sludges having densities of 40 per cent and 25 per cent (solids content), respectively. The first figure probably represents the maximum possible density which can be secured by positive liquor displacement methods, the second figure being what is now the probable average secured by mechanical filtration of raw sludges. Conditioning chemicals (10 per cent lime and 3 per cent ferric chloride) increases the amount of material to be incinerated and decreases its heat value, per pound dry basis. The combustible matters contained in the raw sludge are assumed to be 67 per cent and to have a heat value of 11,000 B.t.u.'s per pound. On this basis the two sludge cakes will consist of the following:

	25% Density with Chemicals*	40% Density No Chemicals
1—Total dewatered sludge	360 tons	200 tons
2—Liquid to be evaporated.....	270 tons	120 tons
3—Dry solids to be burned.....	90 tons	80 tons
4—Volatile matter	54 tons	54 tons
5—Ash content	36 tons	26 tons
6—Heat value of sludge (dry basis)	6500 B.T.U.'s	7400 B.T.U.'s

*Lime 10%; $FeCl_3$ 3%.

It has been assumed that the required capacity of the sludge dewatering equipment and the incinerators will be 200 per cent of the average sludge volumes, but the power production has been based on the average daily

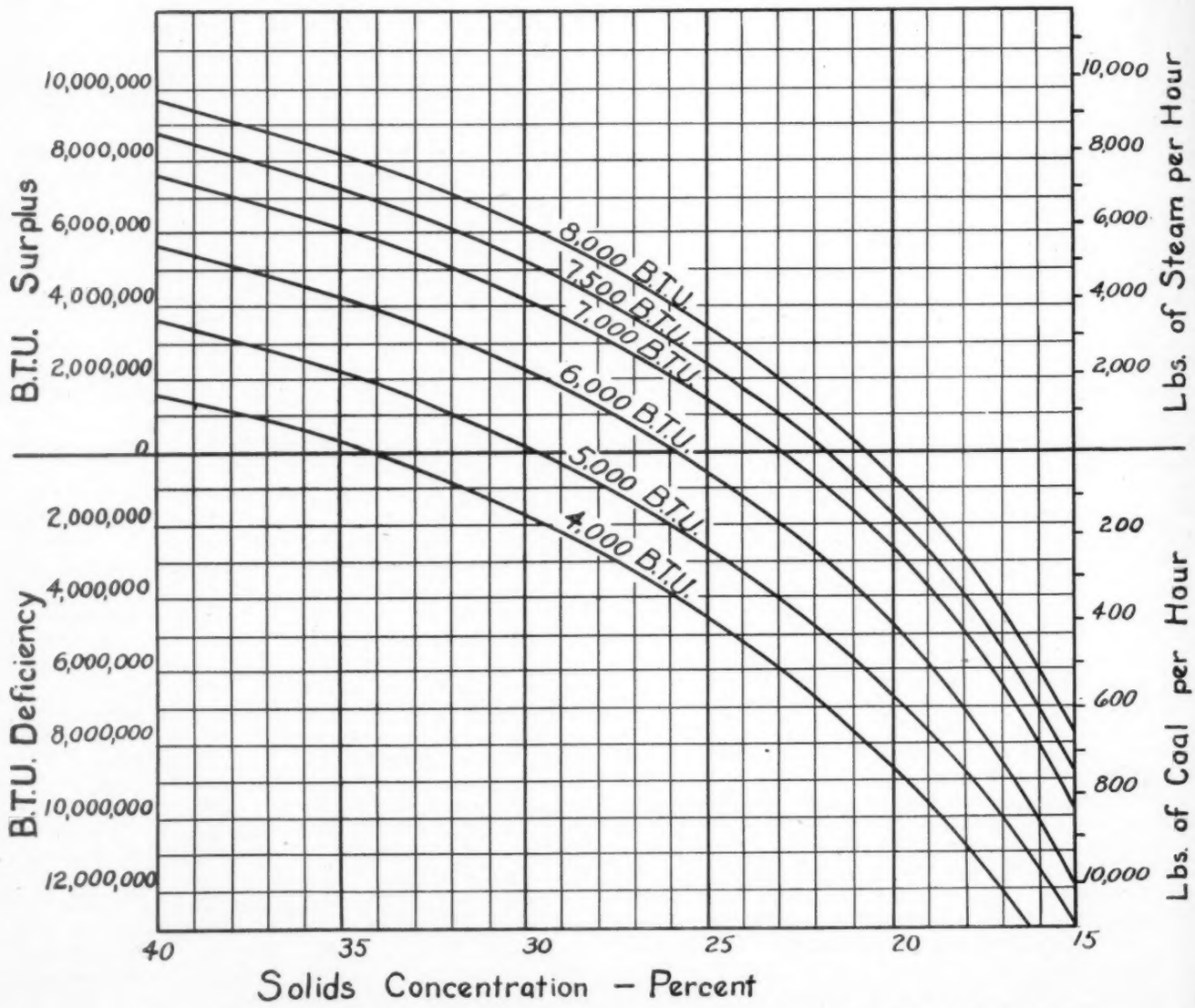


Fig. 17—Sewage Sludge Heat Surplus and Deficiency—Based on 1 Ton Dry Solids Per Hour

sludge volumes. One of the incinerator types previously described (in the June, 1937 issue) gives for these conditions the following tentative heat balance in B.t.u.'s per hour. In this heat balance numerous assumptions were made. It indicates, however, what may become an eventual possibility.

	25% Density with Chemicals	40% Density No Chemicals
1—Sewage combustibles	48,200,000	49,300,000
2—Sensible heat of combustion air	272,000	231,000
3—Sensible heat of leakage air	102,000	99,000
4—Sensible heat of sewage moisture	630,000	305,000
5—Sensible heat of sewage solids	42,000	37,400
Total heat input	49,246,000	49,972,400
6—Steam production	8,421,000	25,495,400
7—Sensible heat stack gases	11,000,000	7,110,000
8—To air heater radiation	150,000	100,000
9—To dryer radiation	150,000	200,000
10—Latent heat of evaporation	24,180,000	11,706,000
11—Latent heat of hydrogen	3,480,000	3,480,000
12—Furnace radiation	1,525,000	1,188,000
13—Sensible heat of ash	340,800	249,500
14—Combustion loss	497,000	494,000
Total heat output	49,743,800	50,022,900

This tentative heat balance shows the necessity of carefully studying the requirements of preliminary sludge treatment. The total heat input, which is based on the heat value of the sludge, is practically the same for both kinds of dewatered sludge. The differences appear in heat output and are mainly in the latent heat of evaporation which, for 25 per cent density sludge, is based on 270 tons of liquid per day of 24 hours; and, for the 40 per cent density sludge, 120 tons per day. The liquid in the sludge, the air for combustion and the dry volatile sludge gives the total weight of gases leaving the incinerator. It can therefore be easily seen that an increase in liquid to be evaporated necessarily results in a higher stack loss for equal stack temperatures, which is shown by the difference in the sensible heat of the stack gases.

The useful heat developed by the incinerator or its efficiency is the total of the heat utilized in steam production, heat of evaporation and credits on heat recovery from flue gases. This is given in the following tabulation:

Useful Heat Developed	25% Density with Chemicals	40% Density No Chemicals
1—Steam production	8,421,000	26,150,000
2—Credit on stack gases	4,050,000	1,656,000
3—Latent heat of evaporation	24,180,000	11,700,000
Total	36,651,000	39,506,000

The efficiency of the incinerator, the combustibles converted into steam, etc., then become as follows:

Incinerator efficiency	73%	78%
Sludge heat to steam production	17%	51%
Total steam production—pounds per hour 250 lb.-100° F. superheat	7,800	25,500
Amount used in computing power development, pounds per hour	7,500	22,500

This tabulation clearly shows the influence of sludge moisture on the amount of steam that can be developed. Another factor is the amount of power required to operate the fans, dryers, etc., which is almost proportional to the amount of liquid evaporated and, for the type of incinerator used in computing the heat balance given, amounts to about 20 K.W. per hour per ton of liquid evaporated. In this instance it amounts to 230 K.W. per hour for 270 tons of liquid and 100 K.W. per hour for 120 tons of liquid evaporated per day.

Based on using condensing type steam turbines, geared to electric generators, the amount of power that can be developed from 7,500 lbs. of steam per hour is 200 K.W.H. and from 22,500 lbs. of steam is 1,250 K.W.H., amounting to 4,800 K.W. hours and 30,000 K.W. hours per day, respectively. In the operation of the sludge disposal plant a certain amount of power is required to operate equipment such as the sludge concentration tanks, the dewatering equipment with its accessories for removing the free liquids from the sludge and for conveyors, elevators, fans, blowers, and other appurtenant incinerator equipment. For sludge dewatering this is controlled largely by the amount of free liquid to be extracted; and, for incineration, by the amount of inert liquid to be evaporated. Up to a certain point it is more economical to extract the moisture by mechanical means than by evaporation, this of course depending on the characteristics and the volumes of sludge to be handled.

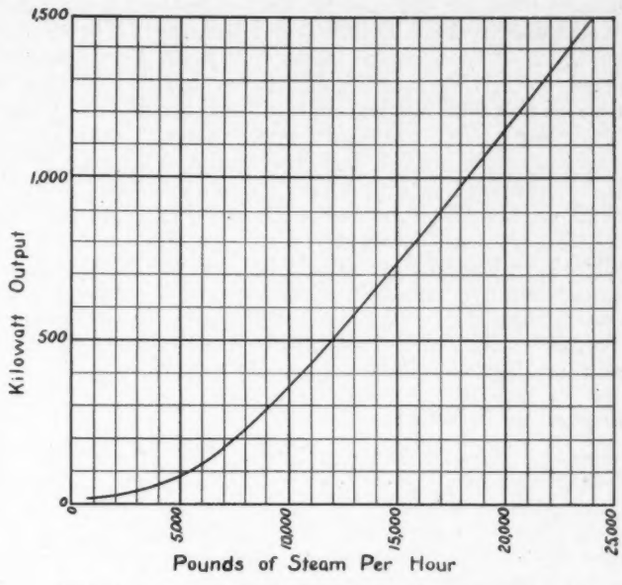


Fig. 18—Steam Requirement of Turbo-Generators

Extending mechanical sludge dewatering to its present practical optimum, which may be a density of about 40 per cent, it appears that power can be developed in an amount considerably in excess of that required to operate the sludge disposal plant, which excess can be used for the operation of motors in other parts of the treatment plant or for sewage pumping, etc.

Where power production is indicated, the addition of auxiliary fuel oil or coal burning equipment and added boiler capacity could be made in an amount necessary to produce sufficient power to operate the entire treatment plant. Such an installation presents interesting possibilities and may effect certain economies in power costs, as it must be considered that but little added plant costs would be entailed in the required additional equipment. Incinerators for an installation of this kind should, it is believed, separate the function of evaporation from combustion and the combustion procedure should be that used for low grade fuels. And, the work in general should follow accepted power plant practice.

Existing Sludge Disposal Methods

There are many factors to be considered in making a comparison of various methods of sludge disposal such as the size or capacity of the treatment plant, the type of treatment used, the location of the plant, the cost and availability of land, the actual and potential nuisance aspects, and the present and future possibilities of final sludge disposition. All of these must be considered in

their bearing on the cost of sludge disposal as any one of them may more than offset what may be otherwise an ideal solution of the sludge disposal problem. Of these various factors, probably the most important is that of the final sludge disposal. In the smaller plants it is more or less common practice to consider that final disposal can be made by the use of the sludge for filling in of low land, for fertilizer, or for soil conditioning. With certain previously stated exceptions, this may be satisfactory for the smaller plants but may not be applicable to large plants due to the volumes of sludge to be handled and disposed of, and the usual comparatively close proximity of the plant to industrial or residential districts, which may require the procurement of land at a considerable distance from the treatment plant.

Disposal by Digestion

Sludge digestion tanks will undoubtedly be continued in the treatment of sewage sludge as they provide a simple means of reducing the organic or volatile constituents. In most plants the gas produced is used to heat the sludge in the tanks and to hold the temperature at the point required for rapid digestion. Several plants use the sludge gas to operate gas engines and use the heat from the engine cooling water and that recovered from the engine exhaust gas to heat the digestion tanks. Present performances indicate that considerable power can be generated from the sludge gas which can be used to operate portions of the sewage treatment plant. The problem of drying digested sludge can for large plants be properly taken care of by vacuum filters or centrifugals. It is possible that centrifugal dewatering may provide means for economical sludge dewatering.[10] For sewage treatment plants handling large amounts of sludge, digestion tanks however may not be economically or otherwise feasible due to other factors than sludge treatment, such as availability of land for final sludge disposal.

In several comparatively large treatment plants digestion tanks, with short detention periods, are proposed ahead of mechanical dewatering equipment and incineration, the gas from the digesters being used to supply auxiliary heat for incineration of the sludge. As compared to vacuum filter dewatering and incineration of raw sludges, such a combination will undoubtedly effect certain savings in chemicals required for sludge conditioning and also in the capital cost of the dewatering equipment, due to the higher filter rates possible with digested sludge. The cost of the incinerator plant will also be decreased due to the smaller volume of sewage solids to be burned. However, should it be possible to dewater raw sludge with little or no chemicals to a density of between 30 and 40 per cent, a careful analysis would undoubtedly indicate that dewatering and incineration of the raw sludge would probably prove the more economical process.

Disposal by Incineration

It is interesting to note the number of incinerator installations which have and are now being made, even in small capacity treatment plants. There are various factors involved in this comparatively recent popularity, and while some of these may be of a commercial nature the major appeal is that of an easily disposable, clean, low volume clinker. To those responsible for sewage plant operation this then appears to be the desired solution of what is otherwise an annoying problem.

Incineration of sewage sludge however is not simply the securing of a clean clinker as operating and fixed charges must of necessity be considered. Many studies have to be made of the various combinations that can be effected, all of which have a bearing on the final cost. At the present time these are about as follows:

A—Vacuum filter dewatering and incineration.
B—Centrifugal dewatering and incineration.
C—Digestion, vacuum filter dewatering and incineration.

In each of these methods of disposal, sludge concentration tanks should form the first step in the treatment as they serve to increase the capacity of vacuum filters or centrifuges and tend to reduce digestion tank volumes.

The first combination (A) would then consist of raw sludge concentration tanks, sludge conditioning tanks where an average of about 10 per cent lime and 3 per cent ferric chloride are added to the concentrated raw sludge, and vacuum filters having a capacity of about 5 pounds of solids, dry basis (sludge and chemicals) per square foot of filter area per hour.[11] The dewatered sludge cake would then be taken to the incinerator plant for evaporation of the inert liquid and burning of the dried sludge.

The second combination (B) would consist of raw sludge concentration tanks and centrifuges to remove the free moisture followed by the incinerating plant. In order to properly take care of daily peak sludge loads the capacities of the dewatering equipment and the incinerators should be in excess of that required for average. For usual plants this can probably be taken as 200 per cent of the average capacity and either provided in capacity for 24 hour service or in additional time of operation. In either case it is reflected in increased capital cost.

The third combination (C) would consist of raw sludge concentration tanks, sludge digestion tanks designed for 20 to 30 day digestion period, gas storage provided in either a separate holder or in combination with the digestion tanks. These tanks would reduce the amount of sludge to be subsequently handled by an amount estimated to be between 25 and 35 per cent. Digested or partly digested sludge would be taken to sludge conditioning tanks, where there is added an average of about 10 per cent lime and 2 per cent ferric chloride and then to vacuum filters, handling this sludge at a capacity of about 6 pounds dry solids (sludge and chemicals) per square foot filter area per hour.[11] The dewatered sludge cake would then be taken to the incinerating plant. In order to take care of daily peak sludge loads it may be necessary to provide additional sludge dewatering and incinerator capacity, but not to the extent required under the two former combinations. The sludge digestion tanks will largely "cushion" these peak loads. Under this scheme of sludge disposal the cost of the plant is increased by the added cost of the digester but this is largely compensated for by the decreased cost of the dewatering equipment and the incinerating plant.

Comparative Costs

It is entirely beyond the scope of this discussion to make any definite statement covering the comparative costs of various methods of sludge disposal. As a matter of fact very few treatment plants keep accurate records of operating costs, including fixed charges for interest and bond retirement, nor do they take cognizance of requirements for increased plant capacity and obsolescence. Further, any costs available do not differentiate between sewage treatment and sludge disposal so that a comparison of estimated sludge disposal costs

must be conscientiously made for each project considered, and must be based on the experience and integrity of the engineer making the comparison. Costs are influenced by the capacity of the plant, the costs of power, chemicals and labor required in the plant, whether or not power can be produced on a scale large enough to operate the sludge disposal plant and possibly other portions of the sewage plant. The final moisture content of the dewatered sludge cake is the determining factor in the cost of the incinerating plant and until more definite results are secured, with equipment now available for sludge dewatering, no real comparisons can be made covering the relative value of direct dewatering and incineration. Should the practice of garbage grinding and its transportation with the sewage to a combined waste disposal plant become further established, then it is believed that direct mechanical dewatering and incineration will be more economical than short period digestion and incineration.

Conclusions

Many improvements have been made in the application and utilization of mechanical equipment for sewage treatment plants and various refinements have been made in the methods of treatment. It now appears that this will be followed by decided improvements in the disposal of the sludge derived from the treatment of the sewage. Practically every large municipality and sanitary district is faced with the serious problem of ultimate sludge disposal. The application of sludge dewatering equipment capable of effecting the removal of such a portion of the liquid as is required for efficient incineration and the installation of properly designed incinerators should merit serious consideration.

This becomes still more pertinent when it is considered that in large plants efficient incineration may not only produce sufficient power to operate the entire sludge disposal plant, but may produce a large excess which can be utilized for other purposes requiring electric power. Where power generation is not practiced certain forms of incinerators are so designed that incineration may be optional and only a drying effected. Such an arrangement makes it possible to seasonally utilize the dried sludge for application to lawns, parks, etc., and at other times the sludge would be incinerated, producing an innocuous ash having about one-third the weight of the dry sewage solids entering the disposal plant. Compared with dewatered digested sludge it has about one-eighth of its volume and is an ash that can be properly used as a fill or placed in a dump with other municipal refuse.

Should the grinding of garbage and its transportation in the sewerage system to a combined garbage and sewage treatment plant become more firmly established, incineration would undoubtedly become still more popular because this method, with mechanical sludge dewatering, would appear to be more economical and less troublesome than other methods now in vogue.

References

10—"Centrifugal Dewatering of Sewage Sludge"—Water Works & Sewerage, April and May, 1936.
11—"Economics of Sludge Disposal"—Water Works & Sewerage, March, 1936.

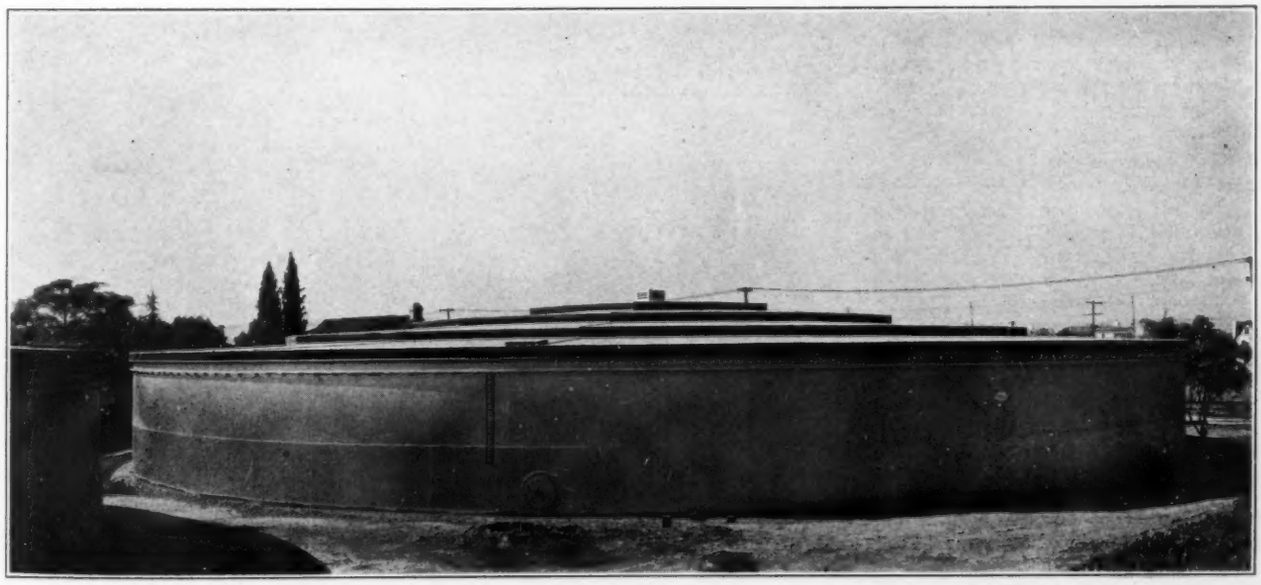
Alhambra's New Stream-Lined Steel Reservoirs

Alhambra, California, has recently completed an economical installation of twin reservoirs for ground storage of 4,600,000 gallons of water, to supplement existing reservoir storage of 2,000,000 gallons.

Each of the new circular steel reservoirs are 140 ft. in diameter by 21 feet deep. The picture shows one of these welded tanks, the lower eight feet of which is below ground, in order to secure a flow line in the twin-storage tanks of like elevation to that of the old adjacent earth reservoir. A happy result was the stream-lined appearance and effective treatment in the way of a flat roof design, which adds novelty and attractiveness.

The bottoms of these tanks rest on an oiled sand cushion, patterned after construction methods used in erecting hundreds of tanks in the oil fields. The under side of the bottom plates and the exterior vertical walls are protected with coal-tar bituminous enamel applied hot. Likewise are the interiors protected, and double checked by spark test for pin-holes or thin spots. The final beautifying outside coats are of aluminum paint.

The installation was made under the supervision of John W. Clay, Water Engineer and Superintendent at Alhambra.

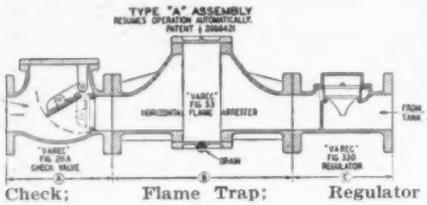


The Attractive Twin Reservoirs of Alhambra—Each 140 Ft. in Diameter; Holds 2,300,000 Gals.

EQUIPMENT NEWS

"VAREC" Safety Equipment for Sewage Works

New to the sewage field, but not to the industrial and gas fields, is "VAREC" safety equipment, manufactured by the Vapor Recovery Systems Co. of Compton, California, which maintains branch offices in 16 principal cities in America and abroad.



Check; Flame Trap; Regulator

"VAREC" Safety Equipment for Sewage Work

The above illustration pictures the "VAREC" Relief Valve and Flame Trap assembly offered now in the sewage field. Other "VAREC" equipment includes gas pressure regulators, back pressure valves and flame arresting shut-off valves.

For the complete catalog of "VAREC" Equipment for Sewage Treatment Plants, address The Vapor Recovery Systems Co., 2820 N. Alameda St., Compton, Calif.

▼

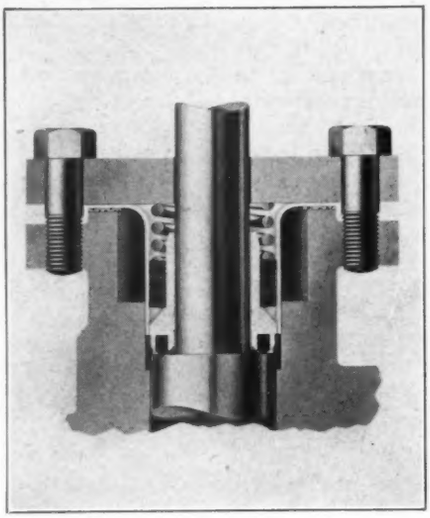
New Seal for Rotating Shafts

The Syntron Company, Homer City, Pa.,* well known in this field as manufacturers of the vibrating type chemical feeders, have just perfected and placed on the market a new Shaft-Seal, of unique design, for eliminating the leakage of gases and liquids around the rotating and oscillating shafts of compressors and pumps.

This new seal has for its main sealing and wearing surface, an anti-friction and self-lubricating compound insert, in bearing metal of the finest quality. The sealing head of bearing metal, with its anti-friction insert, is held firmly against the shoulder on the rotating shaft to be sealed by strong spring pressure which also expands the packing rings, sealing the bearing head to the housing.

This seal has proven as effective and leak-proof on worn and scored shafts as on new shafts—the soft anti-friction insert quickly seating itself in all inequalities on the surface of the shoulder of the shaft.

A distinctive feature of this new seal is the self-centering ring in the sealing head. And, quietness of operation, by elimination of chattering, is assured through the compressed packing rings that grip the seal head up close to the bearing face. The major advantages represented by the manufacturer of this new seal are—the entire elimination of leakage over a long period of time without adjustment—self-seating action—self-lubrication, and self-centering.



Syntron Shaft Seal

The seal is supplied complete, ready for installation, including the seal nose-piece —packing rings—compression spring—seal housing, and gasket. For further details and descriptive folder write the Syntron Co., 650 Lexington Ave., Homer City, Pa.*

*Note: The Syntron Co. have recently moved its offices and factory into a modern manufacturing building, with increased facilities, in Homer City, Pa.

▼

The "Flow-Om-Eter"

The "Flow-om-eter" is an accurate low-cost flow measuring instrument designed for insertion in 4, 6 and 8 inch water mains. Its installation is simple and non-costly, requiring but a 2 inch tap made on the top of the pipe, screwing in of the "Flom-om-eter," and placement of a gate-box over it. The picture is self-descriptive of this compact instrument.

Especially interesting as an income booster is this inexpensive new device for insertion in fire-service lines to detect and record water taken therefrom, legally, illegally, or unknown to the owner of the line. It has a variety of other possible uses at filter plants and on distribution systems—also, in cases of fire hydrant usage for water supply by contractors or others.

The "Flow-om-eter"

The "Flow-om-eter" was conceived, designed and perfected by Mr. A. T. Cook, General Superintendent and Chief Engineer of the Passaic Valley, N. J., Water Commission, who has come to be considered an authority on the use and testing of meters. It is manufactured and sold by the recently formed Northrup and Cook Co., of which Mr. Cook is general manager. Guy C. Northrup, General Sales Manager of Hydraulic Development Corp. (makers of "Hydro-Tite") is president of the new company.

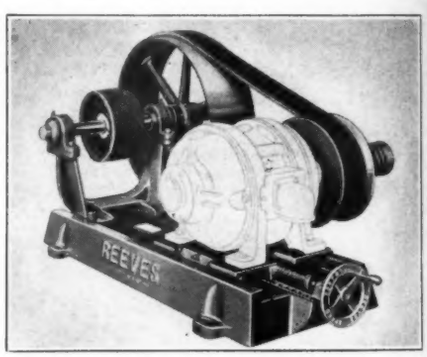
For more detailed description, service records, money saved records, and prices —request Bul. No. 1, "The Flow-om-eter," from Northrup & Cook Co., 50 Church St., New York City.

▼

Improved Vari-Speed Unit

Reeves Pulley Co., Columbus, Ind., well-known manufacturers of variable speed control equipment, has developed a new and improved Vari-Speed Motor Unit.

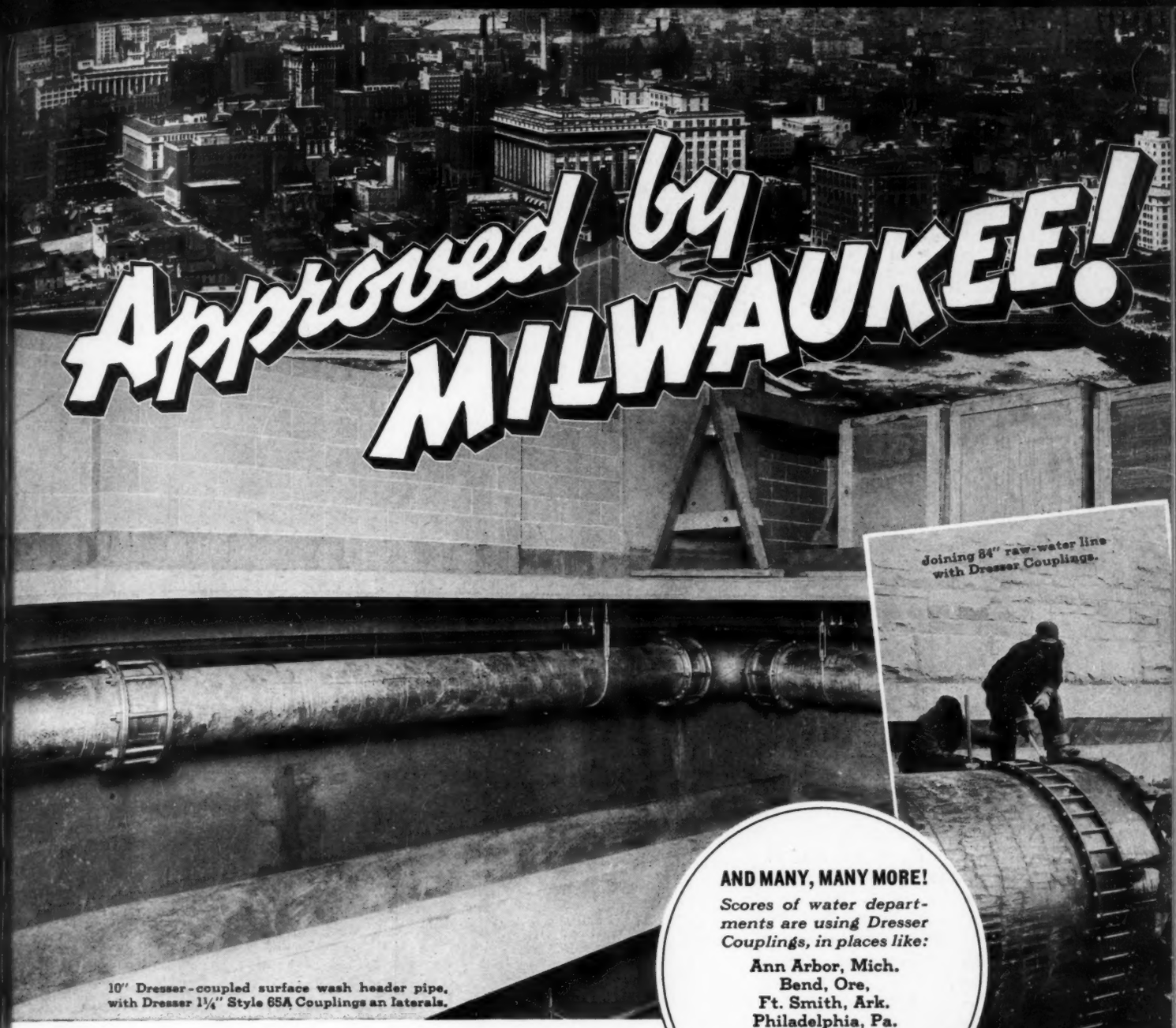
The Vari-Speed Motor Pulley is a simple, compact variable speed unit which is mounted on the standard shaft extension of any constant speed motor. It forms direct drive from motor to driven machine. Through handwheel control, a sliding base on which motor and unit are mounted is moved forward or back, varying the diameters of a set of adjustable discs between which a belt runs. Desired speed changes are made as the belt runs from maximum to minimum disc diameters.



Reeves Improved Vari-Speed Unit

While a straight-face pulley is illustrated, on the countershaft, power take-off may also be from sprocket, pinion multiple V-belt, sheave or any other accepted drive.

The new REEVES Vari-Speed Motor Pulley is built in seven sizes, transmitting from fractional to 7½ h.p., and covering speed ratios of 3:1. For details an illustrated bulletin may be had by writing Reeves Pulley Co. Columbus, Ind.



Approved by MILWAUKEE!

Joining 84" raw-water line with Dresser Couplings.

10" Dresser-coupled surface wash header pipe, with Dresser 1¼" Style 65A Couplings an laterals.

AND MANY, MANY MORE!

Scores of water departments are using Dresser Couplings, in places like:

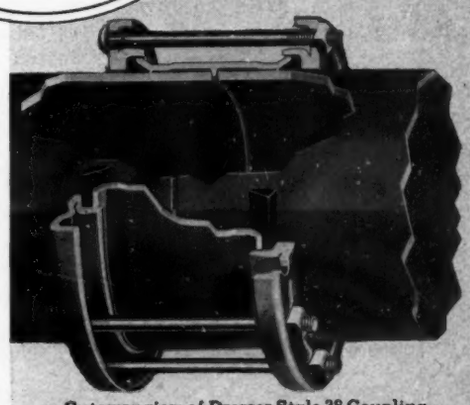
Ann Arbor, Mich.
Bend, Ore,
Ft. Smith, Ark.
Philadelphia, Pa.
Toledo, Ohio
Washington, D.C.

ANOTHER city that marks the trend to Dresser Couplings is Milwaukee, Wis. Sizes including 1¼", 10", 36", 48", 60", and 84" are now in use at their new purification plant—on the raw-water line from pumps to basins, on wash-water lines to the filters, and on piping in the filters!

FIVE REASONS WHY MODERN WATER LINES ARE DRESSER-COUPLED:

1. PERMANENT TIGHTNESS—proved for 50 years, on 150,000 miles of pipe.
2. FLEXIBILITY—normal pipe movements—present in every line—are absorbed.
3. SIMPLICITY—joints are "factory-made"; ordinary labor can install.
4. STRENGTH—predetermined; joints safely withstand any specified pressure.
5. TRUE ECONOMY—a truly lower joint cost throughout the life of the line.

Write for our General Catalog No. 36.



Cutaway view of Dresser Style 38 Coupling, showing working principle. Note that plain-end pipe is used. The resilient gaskets, flexing with the pipe, safely absorb pipe movements.

THE MODERN TREND IS TO DRESSER COUPLINGS

S. R. DRESSER MFG. COMPANY, BRADFORD, PA. • *In Canada:* Dresser Mfg. Company, Ltd., 60 Front St., W., Toronto, Ont.

WANTED

INFORMATION REGARDING WHEREABOUTS OF THIS MAN. Left % Proportioneers % office, Providence, R. I., March 15th, with Treatment Trailer.

Has been reported seen at Florida Section A. W. W. A., Ocala, Fla., at Kentucky-Tennessee and Southeastern A. W. W. A. sectional meetings, Buffalo A. W. W. A. Convention and other such gatherings. Apparently apt to show up at water works offices almost anywhere.

Should you locate JEFF CORYDON in your city, be sure you let him show you the modern way of feeding chemicals, with chemical feeders he has on display in his

TREATMENT TRAILER

% PROPORTIONEERS % Inc.

Associated with Builders Iron Foundry

9 N. Codding Street

PROVIDENCE, R. I.

WITH THE MANUFACTURERS

Columbia Opens St. Louis Office (1106 Central Industrial Ave.)

Vernon L. Clark

Columbia Alkali Corp. announce the appointment of Vernon L. Clark as District Sales Manager in charge of its new St. Louis offices.

Mr. Clark has for some time been representing Columbia products, which constituted the major line of the Clark Chemical Company, established by him in Indianapolis during 1929. This company will continue to distribute Columbia products and retain the name, but Mr. Clark's interest was severed upon becoming Columbia's District Manager.

▼

"Buster" Rand Joins Pittsburgh Meter

C. M. W. Rand, Jr.

Pittsburgh Equitable Meter Company and its subsidiary, Merco Nordstrom Valve Company, announce the appointment of C. M. W. Rand, Jr., to its sales staff.

Mr. Rand was previously employed by the Columbian Iron Works division of Mueller Co. of Decatur, Ill. Mr. Rand has represented this company in California, the southeast, mid-south and Texas where he was well known to the field as "Buster" Rand, and made many friends.

He will sell Pittsburgh Meters and Nordstrom Lubricated Plug Valves in Alabama, Mississippi, east Louisiana and west Florida. He will work out of the Memphis office. To "Buster," our best wishes for success, and lots of it.

▼

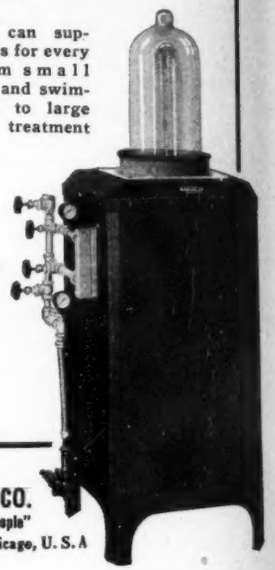
Transite Pipe to Be Produced on Pacific Coast

Johns-Manville Corporation announce that a new million dollar plant is going under construction in Watson, Calif. (near Los Angeles), for the production of Transite water and sewer pipes and Transite conduit in all classifications and sizes. This will be the third plant built to produce Transite pipe from cement reinforced with asbestos fiber—the first being at Waukegan, Ill., and the second at Manville, N. J. The new plant will be in production in 1938.

Announcing The New EVERSON Type "R" Chlorine Feeder

HERE at last is the perfect chlorine feeder featuring the exclusive EVERSON *micro-control*, absolutely accurate feature, combined with the other proven EVERSON features including: Automatic Gas Absorber, Automatic Venting, and the Automatic Vacuum Break which protects against Back-Flooding.

EVERSON can supply capacities for every need—from small water works and swimming pools, to large sewage treatment plants.



Write for New Bulletin

EVERSON MFG. CO.
"The Swimming Pool People"
233 W. Huron St., Chicago, U. S. A

Activated Alum Increases Staff

Robert W. Graham

Burton W. Graham of University of Florida's Department of Chemistry, has recently joined the field staff of Activated Alum Corporation, Baltimore manufacturers of Aluminum Sulphate "Activated" Alum, and the carbon bearing "Black-Alum."

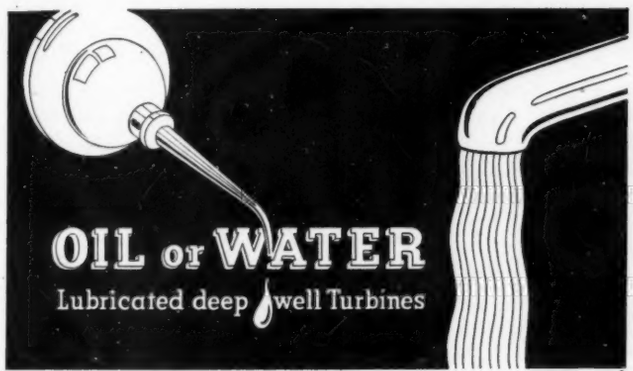
Mr. Graham, who is a graduate of the University of Florida (B.S. and M.S. in Chemistry) has been assistant to Professor Black, under whom he carried forward research in water treatment with special reference to coagulation and coagulants. His experience also includes plant operation at Live Oak and Daytona Beach, Fla. With Activated Alum Corp. he will conduct field work, looking toward improving water treatment and widening the applicability of the coagulants produced by his company.

for extreme Accuracy

Badger Disc Meters have the largest capacities, size for size, with the least absorption of pressure. They are especially sensitive and accurate from the smallest trickle to the maximum capacity flow. Write for bulletin.

BADGER METER MFG. CO., Milwaukee, Wisconsin

BADGER Water METERS



OIL or WATER

Lubricated deep well Turbines

VICTOR - KIMBALL - KROGH *makes both!*

Whichever type your installation requires, you will find the VICTOR KIMBALL KROGH Deep-well Turbine Pump outstanding in maintained efficiency and long, trouble-free life. Dependability since 1864.

VICTOR EQUIPMENT COMPANY
KIMBALL-KROGH PUMP DIVISION

1010 EAST 62nd STREET
LOS ANGELES, CALIF

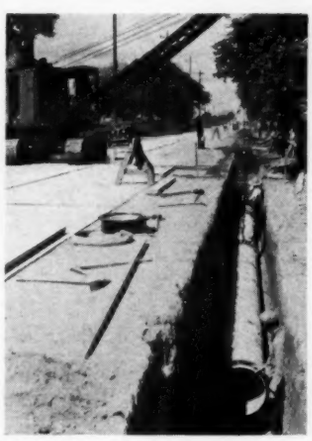
515 HARRISON STREET
SAN FRANCISCO, CALIF

STEEL PIPE

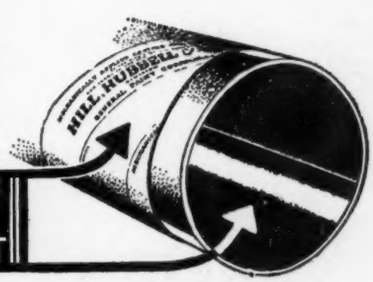
Coated by HILL-HUBBELL Process

INSIDE and OUT meets MODERN STREET CONDITIONS

Conditions surrounding the use of underground water mains are NOT the same that prevailed 100 or more years ago. Concentrated centers of population and MODERN street conditions demand the DURABILITY and STRENGTH that are only to be found in STEEL PIPE. There are MANY reasons why STEEL PIPE, coated INSIDE and OUT, by the HILL-HUBBELL Process, will better meet conditions that become more complex from year to year. STEEL PIPE will stand high pressure, bending and deflection, and the vibrations caused by heavy truck traffic, which has caused so many breaks. For your next main or supply line job check into the MANY ADVANTAGES offered by STEEL PIPE.



FLINT, MICHIGAN
Lowering a 24" O. D. STEEL PIPE. All pipe on this job has been mechanically coated, INSIDE and OUT, by the HILL-HUBBELL Process.



STEEL PIPE coated INSIDE and OUT

The MODERN Way

The HILL-HUBBELL Process of MECHANICALLY coating STEEL PIPE, INSIDE and OUT, is fully described in The Book of Pipe Protection. Use your letterhead, and write our nearest office for your copy.

GENERAL PAINT CORPORATION
HILL, HUBBELL & CO. · Division · Cleveland, Ohio
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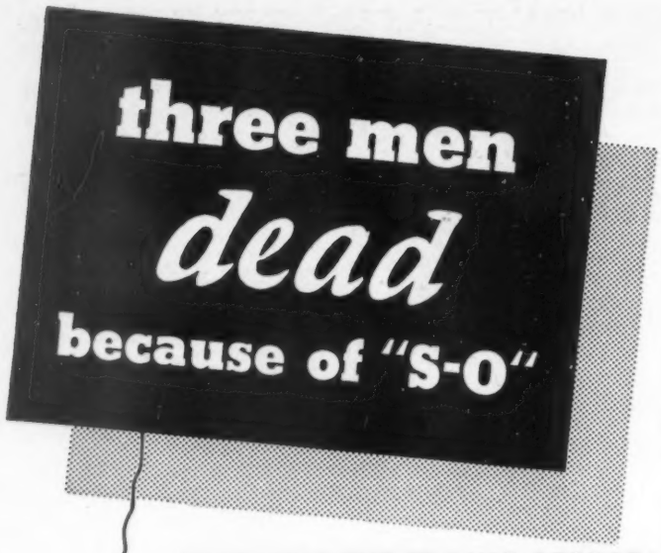

THIS WAS THE TRAGIC RECORD of one California community's experience with sewer odors—sewer odors caused by Hydrogen Sulphide which formed Sulphuric Acid in the lines and attacked the lime in the concrete until the sewers were *destroyed*. Three deaths, and a costly sewerage investment wiped out!

Both hazards from H_2S can be eliminated by treatment of sewage with Bear Brand Chlorine, and today more than a score of California communities are using Bear Brand Chlorine for this purpose. Chlorination neutralizes H_2S and kills the bacteria, thus preventing generation of the gas. In treatment plants, treatment time is often speeded up, thus increasing efficiency and effecting economies in operation.

For methods of chlorinating, as well as for any other sewage treatment problem, Great Western sanitary engineers are available for consultation without charge.

HYDROGEN SULPHIDE DETECTOR—For communities where extensive and constant testing for Hydrogen Sulphide is necessary, this simple, hand-operated instrument recently perfected by Mine Safety Appliances Company is very valuable. We will be glad to supply descriptive literature on request.

Liquid Chlorine • Ammonia • Ferric Chloride

GREAT WESTERN ELECTRO-CHEMICAL CO.

9 MAIN STREET, SAN FRANCISCO
PLANT: PITTSBURG, CALIFORNIA
4151 BANDINI BLVD., LOS ANGELES

MEETINGS SCHEDULED:

Aug. 25-26—CHARLESTON, S. C. (Hotel Fort Sumter).
South Carolina Water Works Association. Sec'y-Treas., B. P. Rice, Chief Engr., State Dept. of Health, Columbia, S. C.

Aug. 26-28—WILMINGTON, N. C. (Cape Fear Hotel).
North Carolina Section A. W. W. A. and Sewage Wks. Ass'n (Annual Meeting). Acting Sec'y-Treas., A. R. Hollett, University of North Carolina, Box 281, Chapel Hill, N. C.

Sept. 13-14—SAN JOSE, CALIF.
California Sewage Works Association. (Ninth Annual Convention). Sec'y-Treas., R. R. Ribal, 701 City Hall, Oakland, Calif.

Sept. 20-22—SANTA FE, N. M. (LaFonda Hotel).
Rocky Mountain Section A. W. W. A. (Annual Meeting). Sec'y-Treas., B. V. Howe, State Sanitary Engineer, State Office Bldg., Denver, Colo.

Sept. 21-24—POLAND SPRING, MAINE (Poland Spring House).
New England Water Works Association. Sec'y, Frank J. Gifford, 613 Statler Building, Boston, Mass.

Sept. 30-Oct. 1—SCHNECTADY, N. Y. (Hotel Van Curler).
New York Section A. W. W. A. Sec'y, R. K. Blanchard, Neptune Meter Co., 50 W. 50th St., New York City.

Oct. 4-6—ATLANTA, GA. (Atlanta Biltmore Hotel).
American Public Works Association (Congress). Executive Director, Frank W. Herring, 850 East 58th St., Chicago, Ill.

Oct. 5-8—NEW YORK CITY, N. Y. (Hotel Pennsylvania).
American Public Health Association (Annual Convention). Executive-Secretary, Dr. Reginald D. Atwater, 50 West 50th St., New York City.

Oct. 5-8—NEW YORK CITY, N. Y. (Hotel Pennsylvania).
Conference of State Sanitary Engineers (Annual Convention). Sec'y-Treas., R. E. Tarbett, U. S. Public Health Service, Washington, D. C.

Oct. 13-15—ATLANTIC CITY, N. J. (Haddon Hall).
Pennsylvania Water Works Association. (Annual Meeting). Sec'y, Dr. F. Herbert Snow, 327 Telegraph Bldg., Harrisburg, Pa.

Oct. 15-16—ELMIRA, N. Y. (Hotel Mark Twain).
New York State Sewage Works Association. (Fall Meeting). Sec'y-Treas., Arthur S. Bedell, State Dept. Health, Albany, N. Y.

Oct. 15-16—ATLANTIC CITY, N. J.
New Jersey Section A. W. W. A. Sec'y, P. S. Wilson, 325 Washington St., Glen Ridge, N. J.

Oct. 18-21—AUSTIN, TEXAS (Driskill Hotel).
Southwest Section A. W. W. A. (Annual Meeting). Sec'y-Treas., L. A. Quigley, Superintendent Water Dept., Fort Worth, Texas.

Oct. 19-20—CINCINNATI, OHIO (Netherland Plaza Hotel).
Ohio Conference on Sewage Treatment. (Annual Convention). Sec'y, Bruce M. McDill, Dept. Health, Columbus, Ohio.

Oct. 21-22—CINCINNATI, OHIO (Netherland-Plaza).
Ohio Conference on Water Purification. Sec'y, Thos. R. Lathrop, Ohio Dept. of Health, Columbus, O.

Oct. 20-23—SACRAMENTO, CALIF. (Senator Hotel).
California Section A. W. W. A. (Annual Convention). Sec'y-Treas., C. M. Hoskinson, 1140, 43rd St., Sacramento, Calif.

Oct. 28-30—ST. PAUL, MINN. (St. Paul Hotel).
Minnesota Section A. W. W. A. (Annual Meeting). Sec'y-Treas., R. M. Finch, 416 Flour Exchange Bldg., Minneapolis, Minn.

Nov. 4-6—RICHMOND, VA. (Hotel Jefferson).
Virginia Section A. W. W. A. Sec'y-Treas., H. W. Snidow, Senior Assistant Engineer, State Dept. Health, Richmond, Va.

Nov. 8-10—GREEN BAY, WISC. (Hotel Northland).
Wisconsin Section A. W. W. A. (Annual Meeting). Sec'y-Treas., Leon A. Smith, Supt., Water Works, City Hall, Madison, Wisc.

April 25-28, 1938—NEW ORLEANS, LA.
American Water Works Association (Annual Convention). Executive Secretary, H. E. Jordan, 29 W. 39th St., New York City.

CATALOGS AND LITERATURE RECEIVED

[Any of the publications reviewed in this section can be secured from or through Water Works and Sewerage, if such be desirable.]

"The Waytrol"—Is a new bulletin from Jeffrey Mfg. Co., which describes and illustrates the principles involved in the precision chemical weight feeder—the Jeffrey-Waytrol—which is sensitized by the "Electric Brain" to instantly adjust the speed of feeding, automatically, to that for which the balance arm on the machine is set. The "Waytrol" is a machine, therefore, which requires no calibration. This, because it feeds exact weights of materials per minute, regardless of the material involved, so long as it will flow from the vibrating hopper onto the traveling weigh-belt. Its functioning is described by the use of explanatory illustrations. Installation pictures also appear. For a copy of "Waytrol" (Bul. No. 644) Jeffrey Mfg. Co., Columbus, Ohio.

"Flocculating and Mixing"—Has come from the Dorr Co. As the title implies the booklet briefly discusses modern mixing and flocculation practices and describes Dorrco Flash Mixers and Dorrco Flocculators (the latter an invention of M. C. Smith, Richmond, Va.) for water purification and sewage treatment works. Advantages attending the use of flocculators are set forth; then follows a review of operating results at representative plants, cross-country. What effective mixing and flocculation has accomplished for the operators quoted, therein, can be done for many more. "Flocculating and Mixing" makes interesting reading—ask for Bul. 6971. Address The Dorr Company, Inc., 570 Lexington Ave., New York City.

"Ramuc and Glazoflex"—No, it's not a vaudeville team—these are the names of two perfectly good enamels, used in water works and sewage plants, which are described in a recent Inertol Co. folder. "Ramuc" is primarily for walls, floors and ceilings of filter plants and pump-stations; interior filter walls; all concrete surfaces, inside and out. "Glazoflex" produces a hard-wearing and attractive enamel finish; especially suitable for pumps, piping, railings, tanks and metal-work generally—also, is resistant to corrosive fumes and chemicals. Attractive illustrations show actual plant applications of these two protective and beautifying enamels. They come in many colors, white and black. Other Inertol protective coatings and mastics are also listed, with a word of description. For a copy of Folder 515—address Inertol Company, Inc., 401 Broadway, New York City.

"Air Compressors—by Worthington"—A new bulletin gives a compact presentation of Worthington's single-cylinder, single-stage, air-cooled and water-cooled, vertical compressors. Important features of construction are illustrated by sectional views. Detailed specifications of the feather-type valves and other principal elements, rating tables and dimensions tables are included. Illustrated also are units complete with vertical or horizontal air receivers, with compressor connected to electric or gasoline motors in a variety of arrangements. For bulletin L-621-B 5 write Worthington Pump and Machinery Corp., Harrison, N. J.

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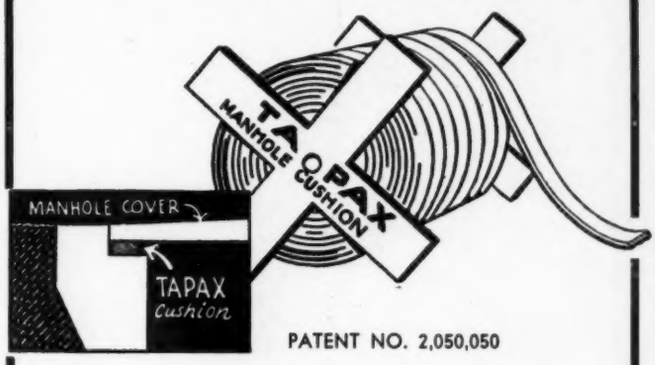

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TAPAX offers the solution for worn and rattling covers by acting as a gasket between cover and frame, eliminating motion, noise and consequently wear.

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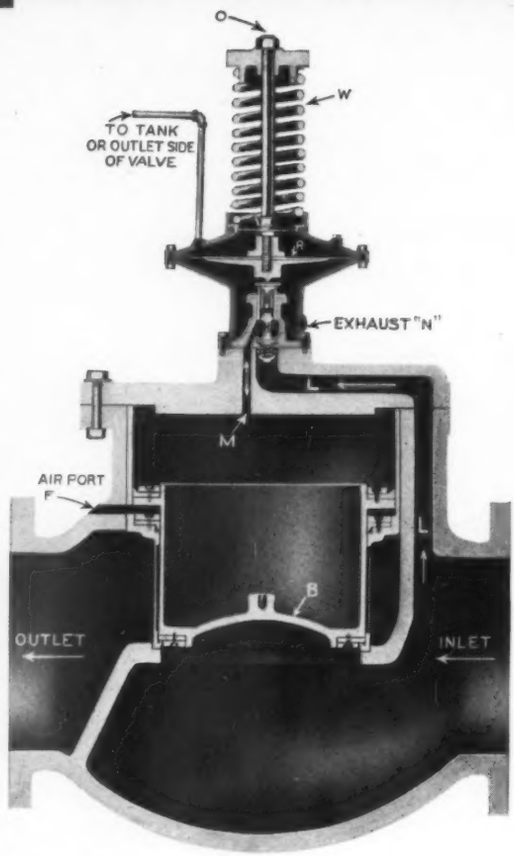

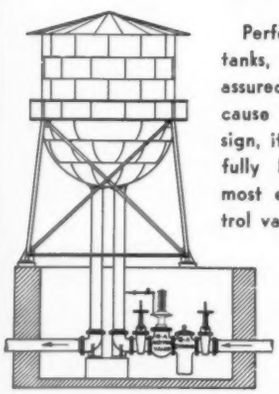

Perfect water-level control in tanks, standpipes and reservoirs is assured by the use of this valve. Because of its correct mechanical design, its rugged construction and its fully bronze construction, it is a most efficient and dependable control valve. Due to efficient air and water cushions this valve always functions without any water surge or shock. It is furnished with automatic, electric and manual control, and for single and double acting service.

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"Portable Mixers"—From Ertel Engineering Corporation, long established in the industrial field, comes a catalog describing and picturing portable mixing equipment for flash-mix, dissolving chemicals or holding suspensions (such as lime or activated-carbon) at constant density while feeding. The Ertel mixers consist of a motor and extended shaft with propellers attached. They are equipped with variable angle clamps for attaching to the sides of tanks, vats or riser tubes. Also, the catalog prescribes laboratory and experimental mixing equipment. For a copy of "Portable Mixers" address Ertel Engineering Corp., 120 East 16th Street, New York City.

"Aurora Pumps"—Recently issued are the three new Aurora Pump Co. bulletins—which are completely descriptive of Aurora's "Deep Well Turbine Pumps" (Bul. 102); "Double Suction Centrifugals," with horizontal split cases, in single (Bul. 105) and two stage (Bul. 106) models. On the latter, specifications emphasize smooth water passages, in the casings, and impeller blades scientifically and correctly designed to produce true streamlined flow. Cut away sectional views, in color, indicate important pump parts and ties in the specifications presented.

"Aurora Deep Well Turbine Pumps" are more elaborately presented in the new eight page brochure. Here, also, is emphasized streamlined flow-design, based on exact formulae; design to avoid the costly cavitation; the necessity of design to assure "team-work" between casing and impeller and, thereby, harmony and efficiency. A listing and pictures of installations and various types of pump drive-heads appear. Any or all of these Aurora bulletins (102, 105, 106) may be had by writing Aurora Pump Co., Aurora, Ill.

"Yeomans Sump Pumps"—From Yeomans Bros. Co., long established Chicago pump and ejector manufacturers; is a comprehensive 20 page bulletin covering, in some detail, the complete line of Yeomans Automatic Electric Heavy Duty Sump Pumps. Reducing, not too well understood, details of pump construction and pump selection to simplified charts and diagrams; and, covering a wide variety of applications with equal directness, this new Yeomans bulletin would seem to be a worthy addition to the files and libraries of engineers. For a copy of Bulletin No. 3000 address Yeomans Brothers Co., 1433 Dayton St., Chicago, Ill.

"Pipe Materials for Sewers"—Is a 24-page illustrated treatise by Hugo Bronneck, Civil Engineer for Building Departments, Vienna, Austria. Written especially for municipal officials, engineers and sewer contractors, it presents Herr Bronneck's views concerning the reliability of sewer pipes of vitrified-clay, as compared to pipes constructed of cements and aggregates. After many pages of analysis of the value and dependability (or lack of such) of competitive sewer pipes, the Viennese engineer sets forth, in summary, his "Reasons for Preferring Vitrified Clay Pipe." Issued, as a reprint by the Clay Products Association, the "Foreword" seems a bit broad, especially in the use of the words "conclusively" and "only." It states—"These writings of Herr Bronneck are a mine of information about sewer problems in general, and prove conclusively that Vitrified Clay Sewer Pipe is the only safe and lasting material for sewer construction, the world over." A copy of the reprint may be had by writing Clay Products Association, 111 W. Washington St., Chicago, Ill.

"More for Your Money"—Is the promise in the title of a new Hobart Simplified Arc Welder bulletin just issued by Hobart Bros. Co. Featured, for light or heavy duty work, is the newly perfected Hobart Horsepower Control, with its advantage in cutting current costs practically in half by improving the power factor, and in reducing starting current. The important features and units of Hobart's Simplified Welder are concisely pointed out, by word and by picture. If you want *"More for Your Money"*—write Hobart Bros. Co., Troy, N. Y.

"A Rust Proof Home"—Is the title of a booklet distributed by The American Brass Co., which describes and picturizes the applications of copper and brass in modern construction. Amongst these are the "Electro Sheets," (paper thin copper sheets), for water proofing cellars, roofs, sidewalls; next—flashing, roofing, gutters and downspouts; "Everdur," the copper alloy rustless hot-water tank, which eliminates complaints against the water supply; service lines and interior piping of copper tubing and red brass pipe, for the same effect, and satisfied customers. This is not a technical publication, but it's an interesting presentation of copper in modern construction, from The American Brass Co., 25 Broadway, New York City.

"Hydraulic Institute Standards — Deep Well Pumps"—The new section on "Deep Well Turbine Pumps" of the *Hydraulic Institute Standards* has just been published. It includes definitions of pump parts and materials; definitions of efficiencies and methods of testing; what to look for in the event of pumping troubles; charts and explanation of column friction losses and mechanical friction in turbine pump line shafts; description of power balance in a deep-well turbine pump; air line method of determining depth of water level; and, a method of plumbing wells. The cost of this new section is 25 cents, or it can be ordered with the complete book of "Pump Standards," which is priced at $1.00. Copies may be had by addressing C. H. Rohrbach, Secretary, Hydraulic Institute, 90 West Street, New York City.

"Caustic Soda"—Like previous brochures of Pennsylvania Salt Co., ("Chlorine," "Ammonia," "Perchloron"), comes an excellent presentation of Caustic Soda in a handsome booklet. Covered are such matters as "Properties of Solid Caustic Soda and Solutions of Caustic Soda" (graphs and tables); "Equipment Requirements in Typical Plant Arrangement for Handling Caustic Solutions" (diagram and specifications); "Safe Methods of Unloading and Handling" (a—Liquid Caustic, supplied in tank cars; b—Solid, Flake or Ground Caustic, supplied in steel drums). To engineers' and chemists' libraries "Caustic Soda" will be a valuable addition. Address Pennsylvania Salt Mfg. Co., (Technical Service Dept.), 1000 Widener Bldg., Philadelphia.

"pH Measurements"—In a revised 32-page catalog, Leeds and Northrup Company presents its full line of apparatus for H-ion Concentration (pH) measurements and pH control equipment for laboratory and plant. Covered, are all forms of the varied line of L & N electrodes, potentiometers, galvanometers for the control and continuous recording of pH in industrial or water and sewage operations. Discussions aid in the choosing of the most appropriate equipment for the job at hand. Some space is devoted to the well known "Micromax"—Recorders now used in continuous recording of sludge gas analysis (Methane and CO_2) and in recording and automatically controlling pH adjustment in water treatment. For a copy of Catalog EN-96 write Leeds & Northrup Co., 4902 Stenton Ave., Philadelphia, Pa.

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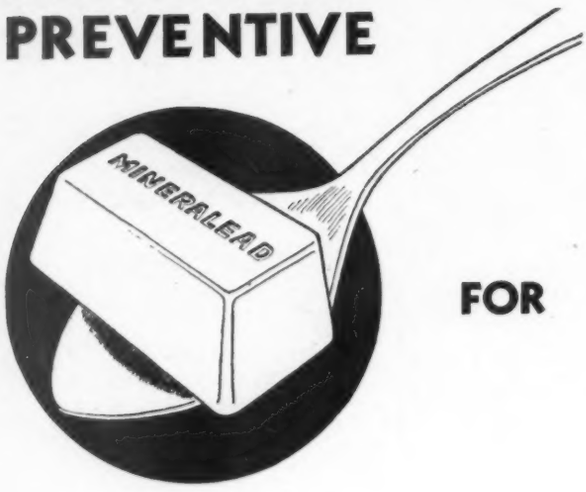

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**September 16, 1936, issue Waterworks Engineering.*

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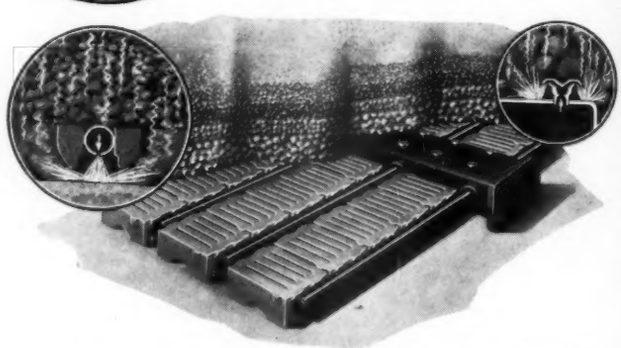

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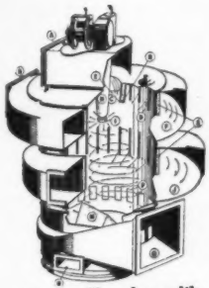

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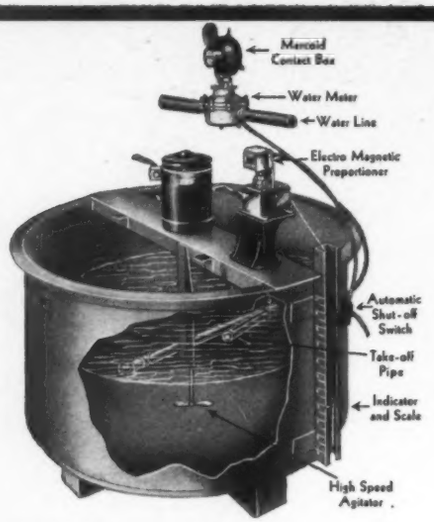

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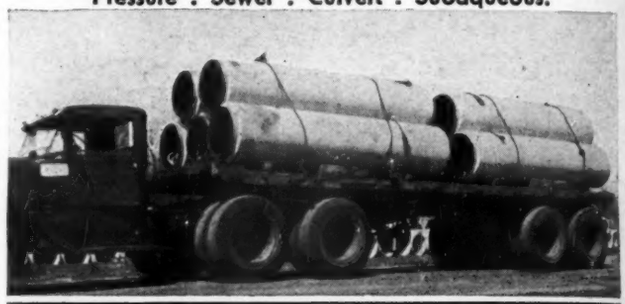

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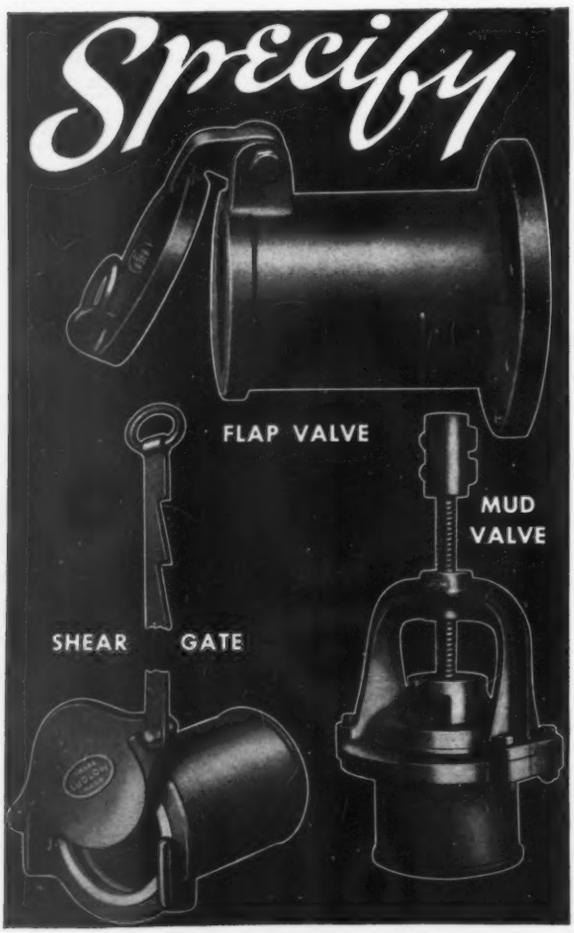

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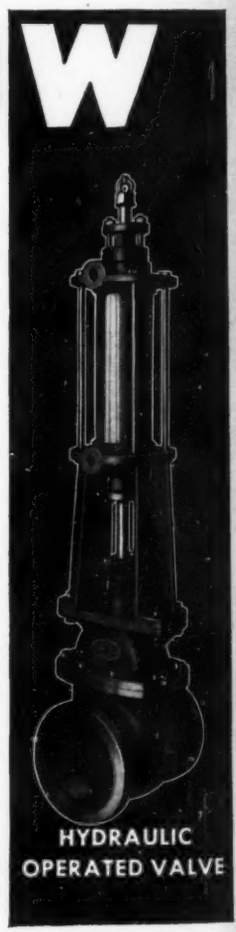

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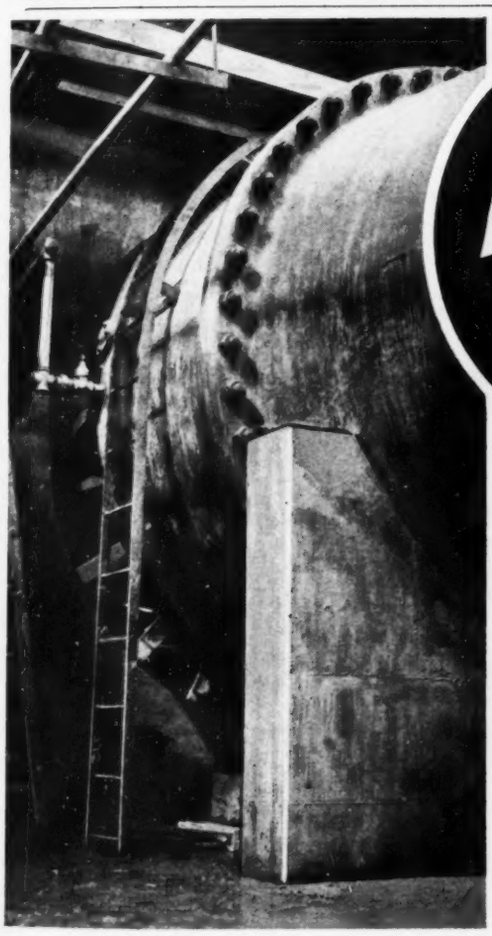

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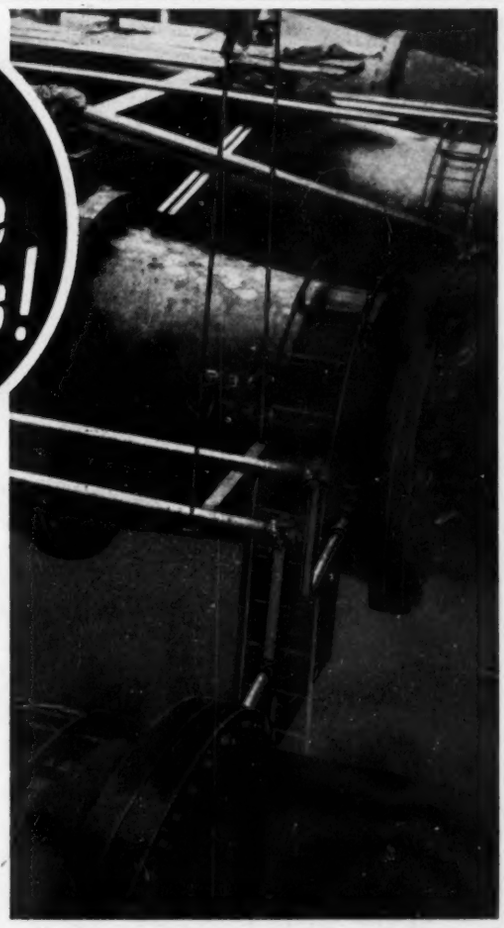

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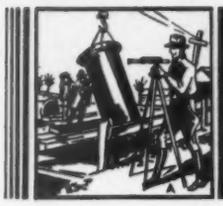

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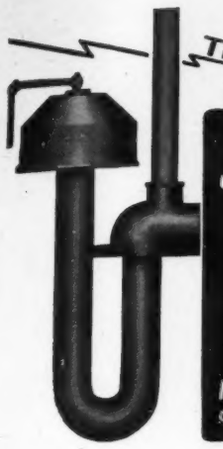

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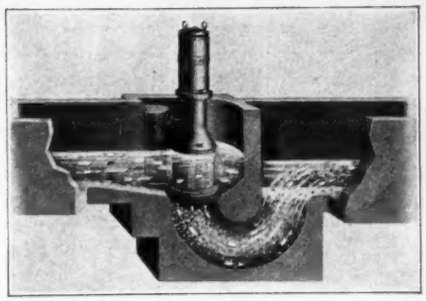

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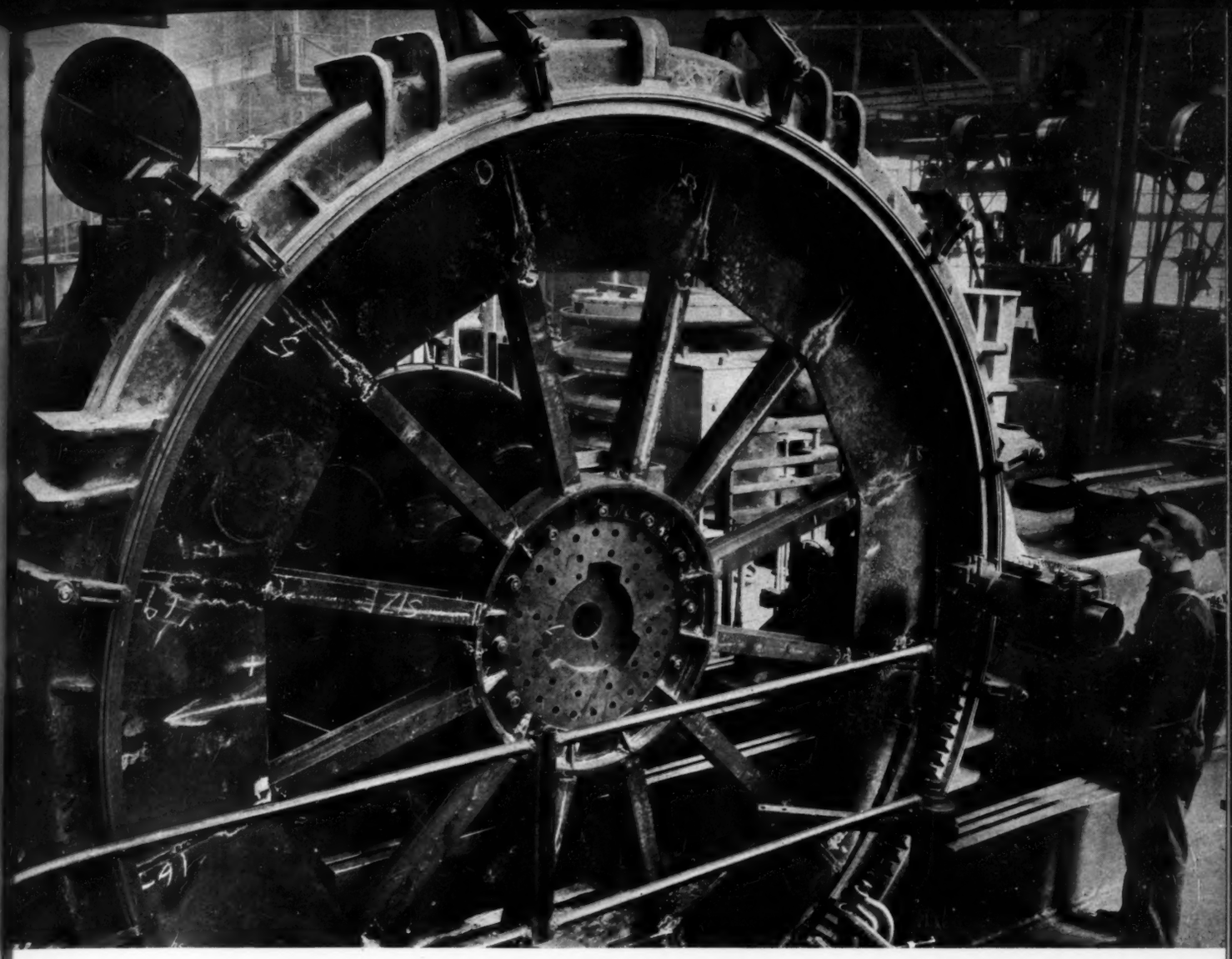

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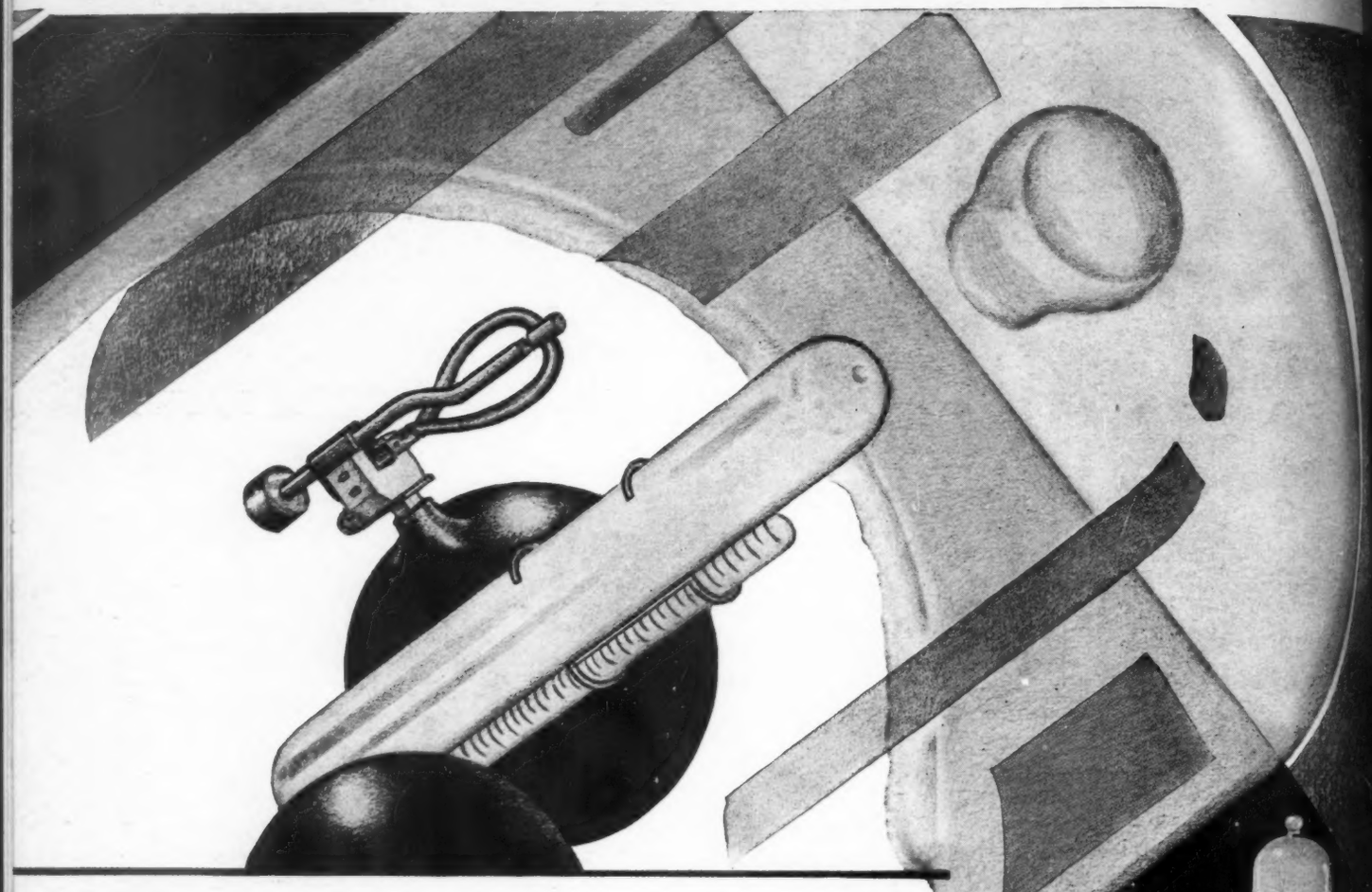

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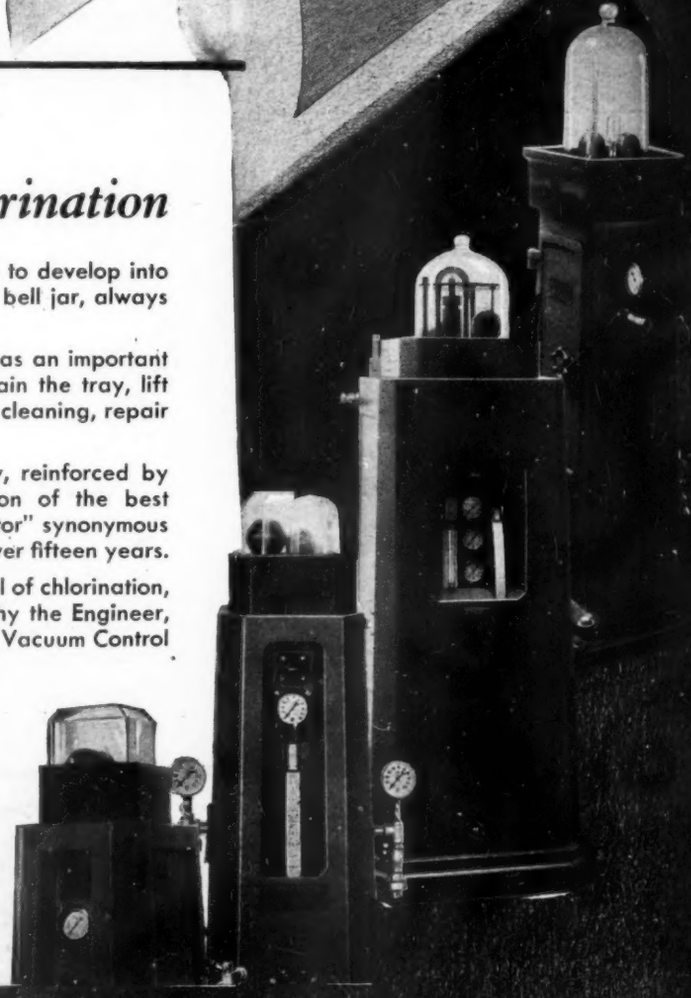

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